This is a preprint of a paper accepted for publication in Socio-Economic Planning Sciences

Sustainability Performance Analysis of Small and Medium Sized Enterprises: Criteria, Methods and Framework

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Abstract

Small and medium sized enterprises (SMEs) play an important role in any economy as they contribute to GDP and employment. However, sustainability (right combination of economic, environmental and social) of SMEs is a major concern as they prioritise economic performance over environmental and social to remain competitive. Majority of prior researches on SMEs' sustainability either look at the impact of a few limited enablers (e.g. lean, green, innovation etc.) on sustainability performance or the effect of pressures and barriers on the sustainability performance. There is a clear gap of a holistic and robust framework for sustainability performance analysis in order to measure and improve sustainability performance. This research bridges this knowledge gap by addressing two research questions – what practice and performance criteria are being considered for sustainability performance analysis in a broad environmental, economic and social context, how are they related, and what methods are being used to derive the relationship between sustainability practices and performance. These research questions are addressed through a systematic literature review of 58 papers, published between 2005 and 2018 in leading journals. First, an objective content analysis is undertaken in order to identify sustainability practices and performance criteria along with their frequency of usage in prior research. Second, the correlation among the variables is studied. Third, the methods for analyzing the relationships of the criteria are identified. Finally, a framework for analysing correlation of SMEs' sustainability practices and performance in order to measure and improve performance using statistical modeling approach is proposed.

Keywords: *Sustainability, practices, drivers, performance, small and medium enterprises, statistical modeling.*

1 Introduction

Small and medium-sized enterprises (SMEs) constitute a major part of the economies of both developed and developing countries (*Cosenz and Noto, 2015; Heinicke, 2018; Jiang and Li, 2010*). SMEs are defined by the European Commission as having less than 250 persons employed. They should also have an annual turnover of up to EUR 50 million, or a balance sheet total of no more than EUR 43 million (*Commission Recommendation of 6 May 2003*). On average, SMEs contribute 42% to a country's gross domestic product (GDP) and provide work for 54% of its labour force (*Ayyagari et al., 2007*). Although SMEs, especially those operating in manufacturing sector, in one hand contribute significantly to the GDP of a country, on the other hand, they also generate negative impacts on the environment as predominantly these companies have not included environmentally sustainable practices in their processes, strategies, or long-term vision (*Rita et al., 2018*). Environmental practices in SMEs are argued to be expensive and hard to adopt. It has been estimated that SMEs contribute up to 70 percent of global pollution collectively (*Hillary, 2000; 2004*). Especially manufacturing SMEs are reported to account for 64% of air pollution whereas only a small portion of 0.4% of these SMEs complies with an environmental management system (see e.g., *Behjati, 2017*). Therefore, SMEs need to start adopting more environmentally-friendly practices to ensure a better future for the generations to come. However, their business is challenging from both demand and supply sides due to numerous competitions.

In the last few years, considerable attention has been focused on the topic of sustainability, integrating and finding a balance between environmental, economic and social aspects of a company (see, e.g. *Epstein and Buhovac, 2014*). Economic front along with the social and environmental aspects are the main constructs of the supply chain sustainability, but they tend to contradict each other (*Tajbakhsh and Hassini, 2015*). The academics and the researchers claim that the supply chain can only be sustainable in the long run if the environmental and the social aspects of the business are also taken into consideration (*Cetinkaya et al., 2011*). The three basic dimensions of sustainability are ecology, economy and social affairs. Nowadays, business sustainability is most often presented in an integrated way, combining these

three aspects, due to their partial overlap. Graphically, this can be described by three overlapping circles, which intersection in the middle represents sustainability (*Stopper et al., 2016*).

The SMEs try to implement the corporate sustainability to adhere to the policy and regulations (*Witjes et al., 2017*). The SMEs attempt to attain sustainability by performing lean manufacturing, green manufacturing and other sustainability practices. There are contradictory findings on correlationship between social and environment practices with corporate sustainability and economic performance of the SMEs. A sustainability practice is any practice aiming at achieving or supporting a sustainable value (*Phan and Kim, 2019*). Sustainability performance can be defined as the performance of a company in all dimensions and for all drivers of corporate sustainability (*Schalteggger and Wagner, 2006*).

There are numerous models and indicators used for supply chain sustainability performance measurement. *Singh et al. (2016)* present an overview of sustainability indicators for companies. There are several approaches that apply statistical techniques for the modeling of firm sustainability performance. Statistical modeling includes least square linear multiple regression (see, e.g., *Lopez-Valeiras et al., 2015; Wolf, 2014; Yu and Rhee, 2015*; *Yu and Zhao, 2015*), artificial neural network analyses (e.g. *Hassan et al., 2015*; *Jawahar et al., 2015*), structural equation modeling (SEM) approach (e.g.*Chang and Kuo, 2008*; *Wan Mohamed Radzi et al., 2015; Youn et al., 2013*) and fuzzy logic analysis (e.g. *Govindan et al., 2013; Rajak and Vinodh, 2015*).

Geng et al. (2017) demonstrate a systematic review of statistical modeling of sustainability practices and performance associations for large companies in Asia. A systematic literature review on the topic of relationship between sustainable practices and performance, followed by a meta-analysis of correlations, can be found in *D'Agostini et al. (2017)*. In another study, *Alshehhi et al. (2018)* analyze the literature concerning relationships between corporate sustainability and corporate financial performance (see also *Golicic and Smith, 2013*). *Goyal et al. (2013)* give also a literature review on the relation between sustainability performance and firm performance. Also, *Mura et al. (2018)* provide a comprehensive review of the sustainability measurement literature in businesses. They deduce that most studies tended to consider only selected aspects of the measurement process and to concentrate on specific issues. *Geng et al. (2017)* identify as the most dominant green

practices being those of "internal environmental management system", "eco-design", "green purchasing", "reverse logistics (recycling, reusing, reducing of raw materials)", "customer demands", "clean technologies" and "reducing waste of water". Reduction of energy use, and reduction of air emissions have been also emphasized in the literature (*Zimmer et al., 2016*). Regarding social perspective of sustainability, research has highlighted as most dominant those of "staff training", "involvement of stakeholders", "health & safety", "donations (for sustainable projects)" and "annual number of accidents" (*Zimmer et al., 2016*). Other suggestions include "reducing land use" (*Winroth et al., 2016*) and "reusable packaging" for extending product life cycle (*Garcia-Granero et al., 2018*).

Although there is a significant number of reviews and meta analyses on sustainability practice-performance relations for large companies, reviews on SMEs are scant. Firm size has been highlighted previously as an influential factor for adopting sustainability practices in companies (e.g., *Geng et al., 2017; Zhu et al., 2008b*), constituting restrictions to small and medium enterprises. While SMEs and large companies operate in the same market, they have significant differences and varied challenges from both supply and demand sides (see e.g., *Thakkar et al., 2009*). Especially regarding the sustainability management in SMEs, it has been given much less attention compared to large enterprises due to certain distinctive characteristics of SMEs. These characteristics may relate to their poor business process maturity and decision making ability, as well as less prioritization on integrated systems for waste and recycling processes. Majority of prior researches on SMEs' sustainability either look at impact of lean, green, innovation and other enablers on sustainability performance or effect of pressures and barriers on sustainability performance (*Dey et al. 2020a*).

This research bridges this knowledge gap by addressing the following two research questions:

RQ1: What practice and performance criteria are being considered for sustainability performance analysis and how are they related, and

RQ2: What methods are being used to derive the relationship between sustainability practices and performance.

Through answering these questions, the current research produces results that are useful for both individual SME and the policy makers, since it is expected to provide information on how SMEs can implement sustainability practices and improve their current sustainability performance.

Through a systematic literature review of papers published between 2005 and 2018 in leading journals, an objective content analysis is undertaken in order to investigate the research questions and identify practice and performance criteria along with their frequency of usage in prior research. This approach is in line with previous research. For instance, *Eslami et al. (2019)*, utilizing systematic literature review, investigate sustainability in manufacturing sector. However the study is not in context of SMEs. *Garengo et al. (2005)* review the performance measurement systems in SMEs and develop a research agenda but this emphasizes on economic criteria. *Mura et al. (2018)* analyse the sustainability measurement research emphasizing on the stakeholders design, implementation and implementation of sustainability. *Hong et al. (2019)* study the sustainability orientation and how the latter helped organisations in their performance outcomes. *Malek et al. (2020)* review articles to bring out the gaps in the sustainable manufacturing.

The organization of the paper is as follows. Following introduction section, which discusses the need for the current critical review, Section 2 provides details on the research methodology. Section 3 demonstrates the results and discusses the implications. Finally, section 4 summarises this review work along with a few concluding remarks.

2 Research methodology

2.1 Identification and selection of the publications

The study adopts secondary research approach by analyzing the papers published in peer reviewed journals till end of 2018. A systematic literature review was undertaken in line with previous research (see, e.g., *Ho et al., 2010*; *Denyer and Tranfield, 2009*; *Fink, 1998*) for the identification and analysis of articles. Table A1 shows the definitions of SMEs across the World as presented in prior literature. The selected articles for our research are based on SMEs across the globe only but not governed by specific number of employees and turnover / sales.

The papers utilized for the current study were initially searched in various bibliometric databases (Scopus database, Web of Science (WoS) database and Google Scholar) in order to obtain the maximum potential number of scientific papers on the subject. The Scopus and WoS databases assist in searching the papers included in the Academic Journal Guide of Association of Business Schools (ABS) list. We also used Google and Google Scholar (GS) to identify additional relevant papers, since Scopus and WoS have limited coverage of publications, and GS citation data is essentially a superset of WoS and Scopus, with substantial extra coverage as recent results suggest (*Martín-Martín et al., 2018*). Any comparison of citation data retrieved from all possible citation sources goes beyond the aim of our study, and is better suited for a purely bibliometric study that could be presented in a bibliometric audience. Appendix (Table A3) shows the papers vis-à-vis the database from where they have been retrieved.

While searching for the papers, boolean search function has been used. The keyword is initially necessary to search for the sustainability modeling of the small and medium enterprises. The choice of the keywords has been inspired by the keywords included in the researched papers. The selected keywords were inserted, and searches were conducted into abstracts, keywords and scientific articles.

With regard to material collection, our literature sample consists of English-language peer-reviewed papers on the sustainability models (i.e. social, economic and/or environmental) in small and medium enterprises. Search period was between September 2018 and December 2018. The papers were searched by their keywords (and variants) and were chosen based on the combination of the themes. The basic selection criteria for the retrieved papers was to restrict reference to small and medium sized enterprises (regardless of sector type) and to include the term "sustainability". The set of keywords are summarised in Table 1 covering the various aspects of sustainability (e.g., sustainability, corporate social responsibility, CSR, green, lean, innovation). Please note that in the research design targeted identify papers from the Scopus database, only the business, management, environmental and accounting journals are considered, excluding non-relevant subject areas. Rest of searches in WoS and GS were unrestricted.

Specifically, the literature search was based on the following pair of keywords, jointly found in title, keywords or abstract: "sustainability", "sustainable development", "model", "modeling", "SME", "SMEs", "small and medium sized",

"environment", "environmental", "social", "economic", "practices", "performance", "management", "green", "supply", "chain", "measurement", "CSR", "corporate", "responsibility".

Section 1: Sustainability	**Section 2: Performance measurement**
Small and Medium Enterprises (SMEs)	Social performance
Sustainable	Environmental performance
Circular economy	Operational performance
Social practices	Performance indicators
LCA	Balanced scorecard
TBL-Triple bottom line	Structural equation model
Green	Statistical Modelling
Sustainable	Multi criteria decision making
Emission	GRI
Reduction in environment	KPI
Footprint	PI
Corporate Social responsibility-CSR	Performance Indicator
Life cycle	Case study
Lean	
Sustainability oriented innovation	
Innovation	
Sustainable manufacturing	

Table 1: Keywords used for retrieving the bibliometric database

These keywords were searched separately and in various combinations in order to maximize the output of searches in the relevant bibliometric databases. Keywords used were intentionally broad in order to ensure identification of all possible related research on the topic (*Geng et al., 2017*). Subsequently, the papers have been screened in detail, using citing references as a secondary source to ensure better coverage. This filtering stage consisted of retrieving a total number of 1,074 documents. The papers were first divided in a theme-wise way to the key search area and then categorised in journals section and finally the methods they had used. The inclusion and exclusion criteria considered in the current study are described in detail in Table 2.

Inclusion Criteria
Articles found on the criteria of: Sustainability, measurement in organisation, performance measurement, benchmarking, environmental sustainability aspect, manufacturing sector, small and medium enterprises (SMEs), sustainable manufacturing.
Exclusion Criteria
Sustainability and/or corporate social responsibility (CSR) in general, measurement aspects other than statistical measurement model, financial performance, ethics, case study, multi criteria decision making. Human resource management practices only. Sustainable development.

Table 2: Summary of the paper selection process (inclusion/exclusion criteria)

The search using the above mentioned keywords identifies the desired papers for this review. The inclusion criteria identify 545 papers from Google Scholar, 394 papers from Scopus and 135 from Web of Science. The exclusion criteria yield 58 papers from Google Scholar, 34 papers from Scopus and 20 papers from Web of Science. By taking into account the overlap of papers appearing in more than one database, results in 58 unique articles that are considered for this review paper. Figure 1 demonstrates the steps for selecting the papers. Detailed information of the final selected papers and relevant database they were retrieved from is included in Table A3 in the Appendix.

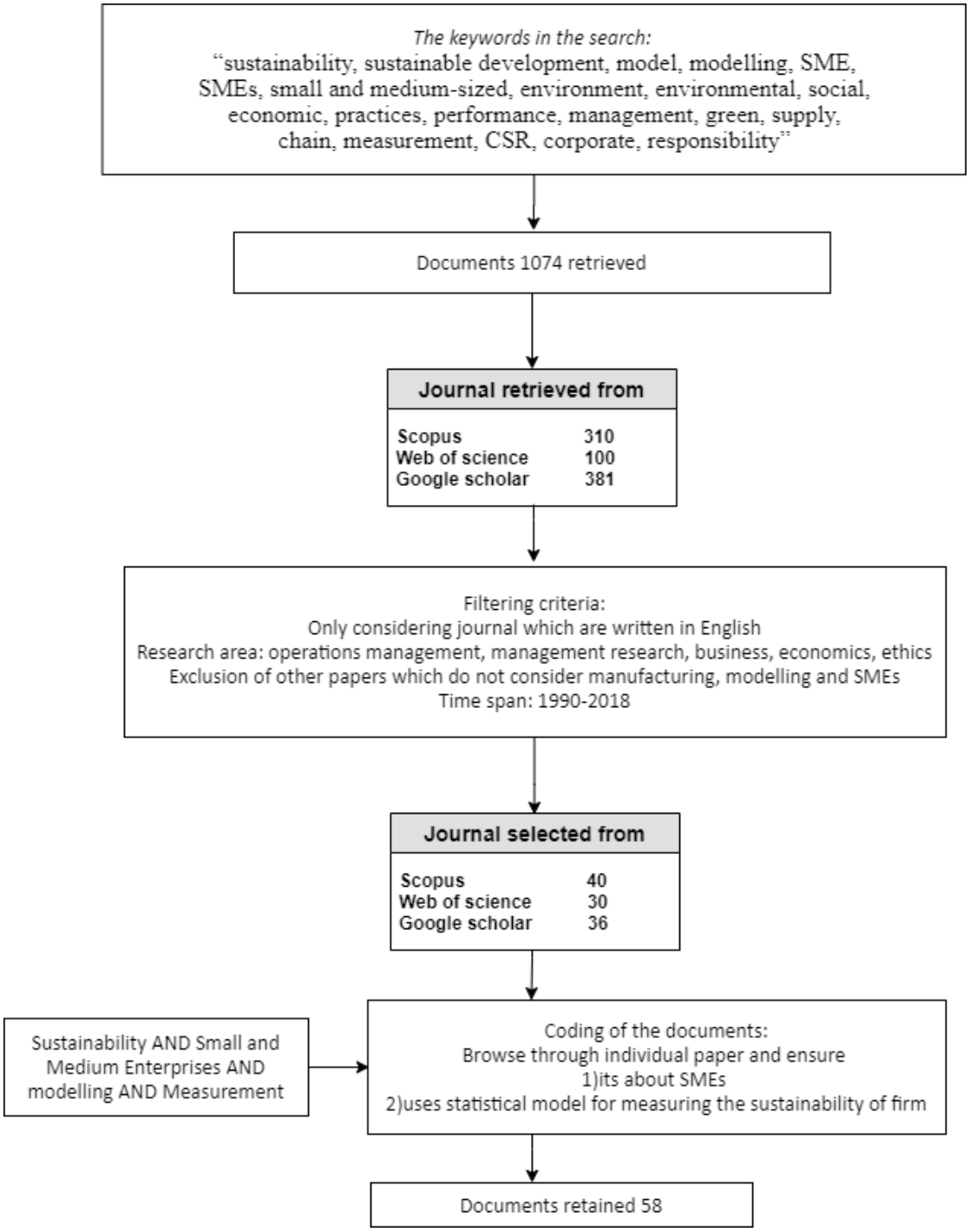

Figure 1: Steps taken to select the papers for this review

2.2 Framework for the Analysis

Both the research questions - what practice and performance criteria are being considered for sustainability performance analysis and how are they related, and what methods are being used to derive the relationship between sustainability practices and performance are answered through content analysis of the selected papers. Firstly, the word cloud method is applied to identify the criteria for sustainability practices and

performance. Word clouds are a method for visually presenting text data. They are popular for text analysis because they make it easy to spot word frequencies. The more frequent the word is used, the larger and bolder it is displayed. Secondly, the relationship between sustainability practices and performance criteria is derived from the content analysis of the selected literature using frequency of the specific association. Thirdly, descriptive statistics is deployed in order to derive the frequency and percentage of the methods (techniques and software) that are used to analyse the relationship between the practice and performance criteria. Figure 2 depicts the framework for the analysis. Finally, through content analysis of all the selected papers a holistic sustainability performance analysis framework is presented, which could be adopted in any SMEs.

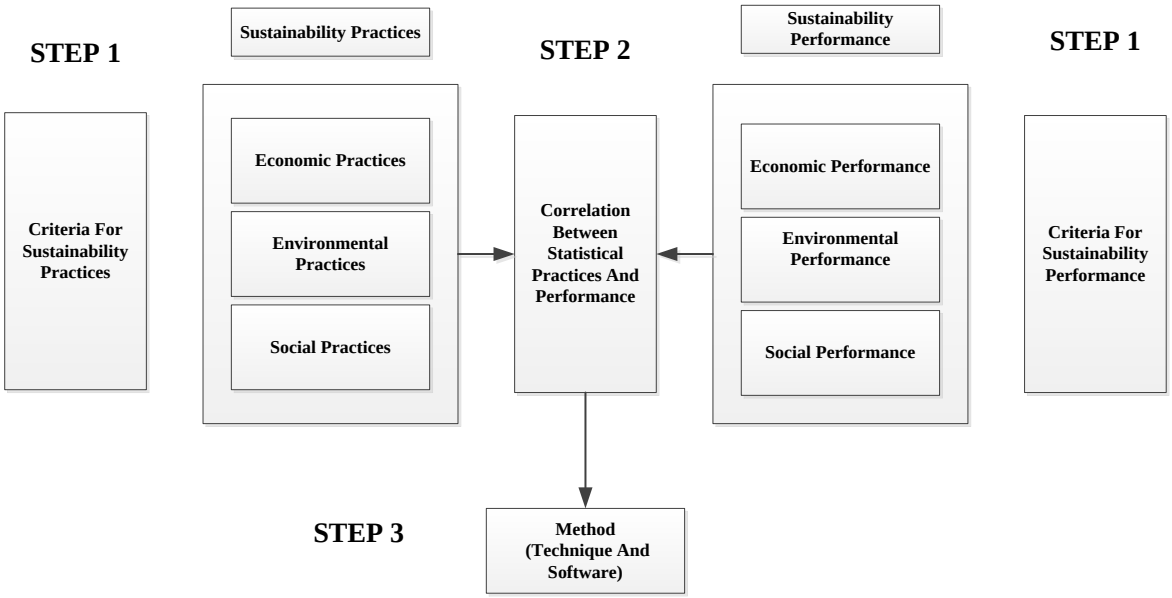

Figure 2: The framework for the analysis

3 Results and Discussion

The following paragraphs demonstrate the results of the content analysis of the 58 selected papers.

3.1 Characteristics of the Sample

Figure 3 shows the number of papers published in each year from 2005 till 2018. The figure indicates the steep increase in publications in last five years starting from 2014, with a peak at 2018. This shows the recent interest of scientific research on the subject.

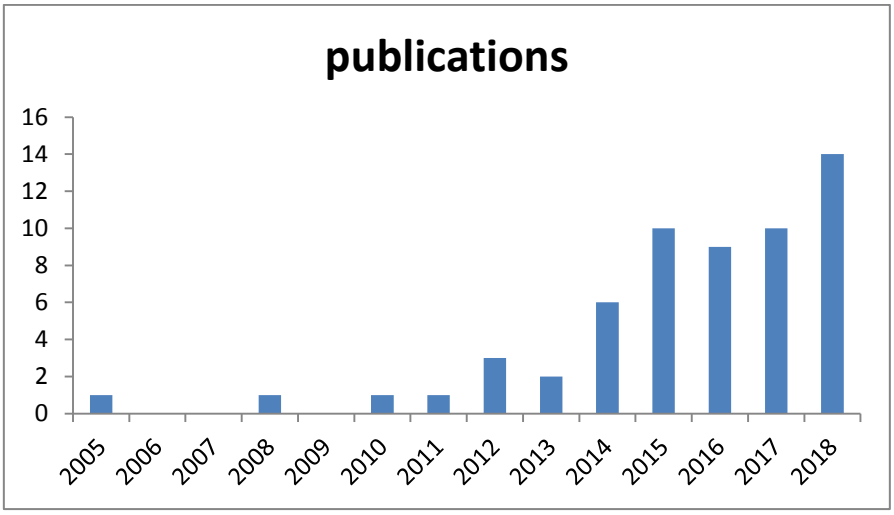

Figure 3: Distribution of identified publications in time

Tables A2 and A3 are the outcomes of our content analysis. Table A2 is the brief of each selected paper covering research questions / objectives, methodology, findings and implications. Table A3 depicts sustainability practice and performance criteria, models / methods, and software that are adopted in prior research. Additionally, all the papers have been segregated with respect to country and sector (e.g. industry type). Table 3 provides a list SMEs' industries, from where the secondary information was gathered for this research.

Type of SME	Frequency	Percent	Cumulative Percent
Manufacturing	30	42.3	42.3
Across various sectors	14	19.7	62.0
Industry (various sub-sectors)	13	18.3	80.3
Services	5	7.0	87.3
Construction	2	2.8	90.1
Merchandizing	1	1.4	91.5
Not mentioned	1	1.4	93.0
Processing	1	1.4	94.4
Retail	1	1.4	95.8
Logistics	1	1.4	97.2
Supply chain	1	1.4	98.6
Trade	1	1.4	**100**
Total	**71**	**100**	

Table 3: Descriptive statistics based on the industry type of collected sample (Note: Results add up to more than 58 SMEs because multiple responses were present)

As one observes, the vast majority of SMEs originate from the manufacturing sector (42.3%), followed by industry (18.3%) and services (7%). Especially industry covers various and diverse sub-sectors, such as automobile and mining industries. There are also many studies, however (19.7%) that have collected samples from various sectors, not concentrated thus on a single type of SME.

Number of SMEs by geographical region	Frequency	Percent	Cumulative Percent
Europe	33	40.7	40.7
Asia	29	35.8	76.5
Africa	11	13.6	90.1
North America	4	4.9	95.1
South America	2	2.5	97.5
Central America	1	1.2	98.8
Australia	1	1.2	**100**
Total	**81**	**100**	

Table 4: Descriptive statistics based on the geographical region of origin of collected sample (Note: Results add up to more than 58 SMEs because multiple responses were present)

Table 4 summarizes the geographical location of origin of SME samples through frequencies and corresponding percentages. According to these results, the SME data are most frequently collected from European and Asian countries (40.7% and 35.8%, respectively). Most typically, samples in Asia are from Malaysia (11.1%), India (9.9%) and Indonesia (3.7%). Most research in Europe has included samples from Spain (7.4%), France (7.4%) and the UK (4.9%). The results are interesting as it is observed that over half of research (53.1%) has been conducted in a total of seven countries, most of which are developing countries, such as Indonesia, India and Malaysia. Rather unexpectedly, we observed that research has been conducted using data from South Africa (7.4%) by Asian and European researchers. A graphical summary of the above results is presented in Figures A1-A3 in the Appendix.

The analysis further reveals that there are also important variations regarding the acquired SME sample size used for the collection of data. Specifically, descriptive statistical analysis showed that the average sample size is approximately 251 SMEs, with a standard deviation of 188.2. The minimum sample collected was 30 SMEs

(*Juniarty and Ismail, 2015*), whereas the maximum sample involved a total number of 997 SMEs (*Bourlakis et al., 2014*). A visual representation of sample size collection is provided in the following histogram (Figure A4).

Table A6 in the Appendix presents the summarized results associated with the journals of the published research. As we see, regarding journals where reviewed papers appear most often, the summary results show that the highest ranking journal is Sustainability (18%), followed by Journal of Cleaner Production (JCLEPRO) (14%), Annals of Operations Research (ANOR) and Procedia – Social and Behavioral Sciences. The rest of the papers are distributed in a wide range of journals.

3.2 Criteria for Sustainability Practice and Performance and their Relationship (RQ1)

First, using the word clouds method a visual representation of the terms' frequency counts in the data set (filtering out commonly used verbs, adjectives, pronouns, etc.) is undertaken in order to identify the criteria for sustainability practices and performance. In this way, a larger visual representation of a particular term, implies that it was used more frequently in comparison to the rest of terms being analyzed. Figure 4 presents visually frequencies of words used for describing the sustainability performance criteria in the statistical models. Figure 5 summarizes the criteria for sustainability practices as used in selected 58 papers (representatives of prior research till 2018). The analytical descriptions of criteria (both practice and performance) are described in Table A3 in the Appendix.

Figure 4: Word cloud of sustainability performance criteria

Figure 5: Word cloud of sustainability practice criteria

A few interesting outcomes emerge from the inspection of both the plots. Firstly, it can be seen from the word cloud of sustainability performance criteria (Figure 4) that the term 'performance' of SMEs is most prominent. In particular, performance is mostly focused on the economic and the environmental structures of the companies' sustainability measurement. Hence, there is a clear indication that the majority of the research in sustainability modeling of SMEs is focused primarily on the measurement of the economic performance and secondary the environmental performance, with much less attention being paid upon the third pillar of sustainability, i.e. the social performance. Terms that appear more frequently in the outcome part of the related models are mainly associated to economic aspects of company's performance, such as "financial", "operational", "cost", "profit", "market", "competitiveness", "quality" and "growth".

On the other hand, the graphical representation of the frequency of terms used for the sustainability practice criteria of the examined modeling approaches reveal different outcomes (Figure 5). It is observed that most researches are linked to the environmental and social aspects of sustainability practices instead of economic. Also, frequently used terms are those of "innovation", "recycling", "customer", "manufacturing", "firm", "lean", "orientation" and "responsibility".

A general finding from the above results is that prior researches on SMEs' sustainability mostly investigate the causal effects of sustainability management practices related to environmental and social criteria with economic and environmental performance.

Figure 6 below depicts a clearer view on the directions of main stream of research, since that additionally to the previous word clouds, it further depicts frequencies of the examined associations between the practice criteria and the performance criteria, which most often appear in the reviewed papers. Table A4 shows the association of practices and performance criteria with frequency and percentage figures. The reviewed literature reveals that the vast majority of research studies the effects of economic, environmental and social practices on economic and environmental performance within SMEs.

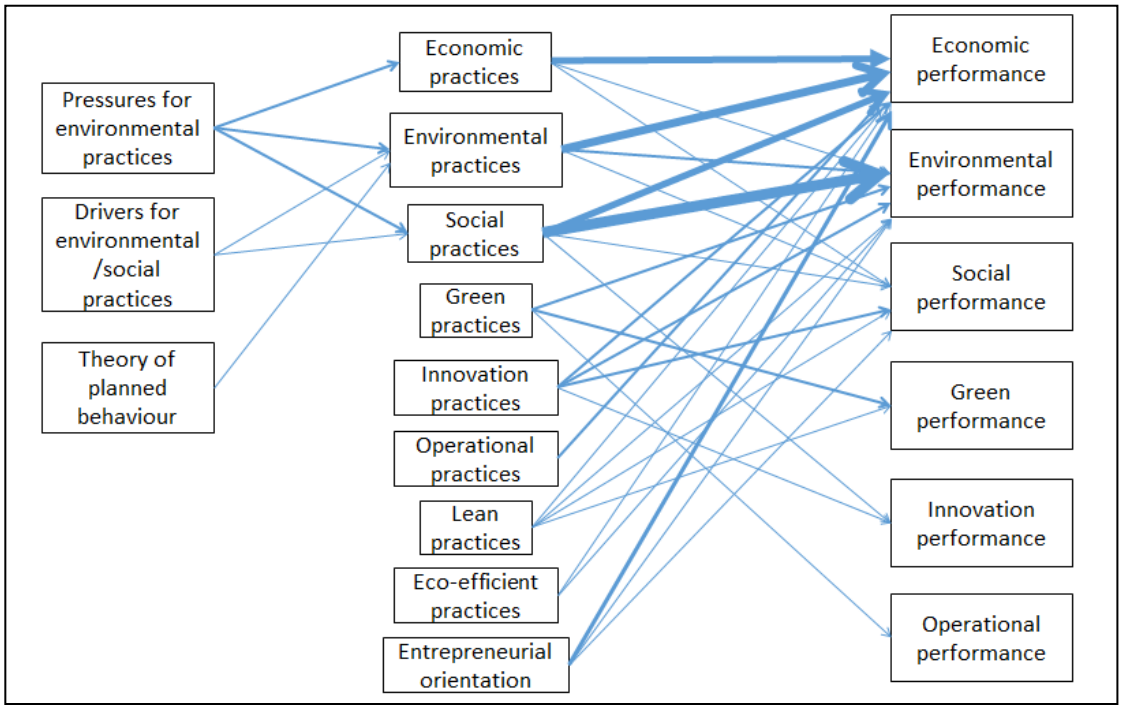

Figure 6: Summary of the most frequently utilized associations between the various sustainability practices and performance criteria as obtained from literature review (line density in the connection arrows corresponds to the frequency of the specific association)

Table A5 presents the number of practice and performance criteria that each research paper utilized for their statistical analyses. At this point we must note that, for presenting the review results in terms of describing the criteria used by the authors, we have chosen to retain the original terminology and set of definitions appearing in each paper. This approach is followed due to the existence of distinct differences between similar criteria. For instance, despite similarities between criteria-used for the description of green and environmental sustainability practices/performance, the two terms do not fully coincide. Although sustainability (including environmental aspects) includes eco-friendly activities and green products, green does not necessarily mean sustainable. "Green" is considered by authors as a combination of various strategies intended to achieve and improve environmental performance, generally integrating environmental thinking into supply-chain management. In the reviewed papers the "green" criteria considered were green manufacturing, marketing, green purchasing and green supply chain management etc., focusing more on producing green products. The main environmental criteria summarised from authors attempt to reduce environmental impacts of SMEs operations by trying to reduce material used, electricity, water, waste, air emission,

natural resource and recycle of material. Eco-efficient practices also differentiate from environmental and green strategies, since that the former refers mainly to eco-friendly products that contribute to green living. The eco efficient criteria consider in the papers are green design, environmentally conscious design, life cycle design, clean design and sustainable design, eco culture, eco product innovation and environmental management system (EMS) strategy.

Several conclusions can be drawn from the summaries depicted in Figure 6 and Table A4. Evidently, the majority of examined associations are those between sustainability practices and performance, in terms of their economic, environmental and social sub-criteria, however the frequency of these connections is not uniform.

Specifically, it appears that the researchers in the field, are mainly concerned with examining the associations between environmental practices and economic performance (e.g., *Agan et al., 2013*; *Habidin et al., 2016*; *Li et al., 2017*) as well as between social practices and environmental performance (e.g., *Akhtar et al., 2014*; *Habidin et al., 2016*; *Masocha, 2018*). Social practices are also examined in terms of their effects on the economic performance of SMEs (e.g., *Cantele and Zardini, 2018*; *Courrent et al., 2018*). This is also true for the association between economic practices and relative performance. Less frequently attempted approaches are examining connections between economic practices and environmental/social performance (*Malesios et al., 2018a*), and environmental/social practices with social performance (*Vidodh and Joy, 2012*). It appears that the social dimension of sustainability performance is most of the times missing from the proposed modeling approaches. This could be identified as an important differentiating factor between larger companies and SMEs, since that nowadays social practices and performance in large enterprises has become a key element for enhancing their sustainability (*Gimenez and Tachizawa, 2012*).

There are various possible reasons for the above outcomes. One reason could be that SMEs are not oriented towards social responsibility as much as they are concerned on their economic and environmental aspects. Another reason is that social practices are perceived as capital intensive. SMEs emphasize on their economic performance as there is no obligation for providing formal sustainability reports to the regulators. SMEs undertake sustainability initiatives due to pressure from either customers and / or policymakers. Customers currently emphasize more on the carbon footprint reduction through energy efficiency and waste reduction compared to CSR

improvements and other measures for social wellbeing (*Dey et al. 2018a*). On the other hand, social practices and their implementation is not as objective as that of economic and environmental practices, and depends more on self-motivation of the concerned SME (*Dey et al. 2018a*).

Besides the aforementioned most frequently utilized connections, there are also scant attempts to engage entrepreneurial orientation practices with economic performance or innovation and operational practices with sustainability performance. Especially in the last few years, there are more tendencies to include the term green (see, e.g. *Mafini and Louri-Okoumba, 2018*; *Idris et al., 2017*), lean practices (see, e.g. *Cherrafi et al., 2018*; *Dey et al., 2018b; Sajan et al., 2017*) and process innovation (see, e.g., *Cherrafi et al., 2018*; *Dey et al., 2018b*; *Hami et al., 2015*; *Malesios et al., 2018b*).

Lean (manufacturing) practices may be described as a management and production system intending to increase customer satisfaction in a profitable way through waste reduction. The concept originates from the Japanese automotive industry. Lean manufacturing in SMEs refer to reduction of waste, process optimisation etc. (*Rashid, 2015*). The concept of lean practices and environmental sustainability is complementary and governed by three principles, namely the "process centered focus", "waste reduction", and "high level of people involvement and participation" (*Martínez-Jurado and Moyano-Fuentes, 2014*). *Dey et al. (2018b)* showed through empirical research that lean practices effects on sustainability performance of SMEs are more, compared to the effects of process innovation.

The main goal of green (manufacturing) practices is the optimization of industrial production in such a way that the processes and systems have minimal or no effects at all on the environment (*Dornfeld, 2012*). Although green manufacturing includes aspects of economic and environmental practices, it lacks the social aspects (e.g. equality, wellbeing) of sustainability. The latter, may be considered a precursor of sustainable production and can be distinguished by omitting the social criteria. Green manufacturing has been considered in SMEs to consist of green practices and renewable materials.

Noteworthy mentioning is also the few relatively recent attempts to examine the effects of pressures/drivers towards the adoption of, mainly, environmental and social sustainability practices within the SMEs. finally, we should make a note on the

lack of research on associations between the circular economy implementation in SMEs and their sustainable development (*Prieto-Sandoval et al., 2018*).

In summary, Figure 7 restricts our findings to the basic three sub-criteria of sustainability practices and performance. As is evident, the proposed and applied interrelations of the basic three dimensions of sustainability demand for further research, especially concerning the rather arbitrary choice of certain criteria among the sustainability practices and performance criteria.

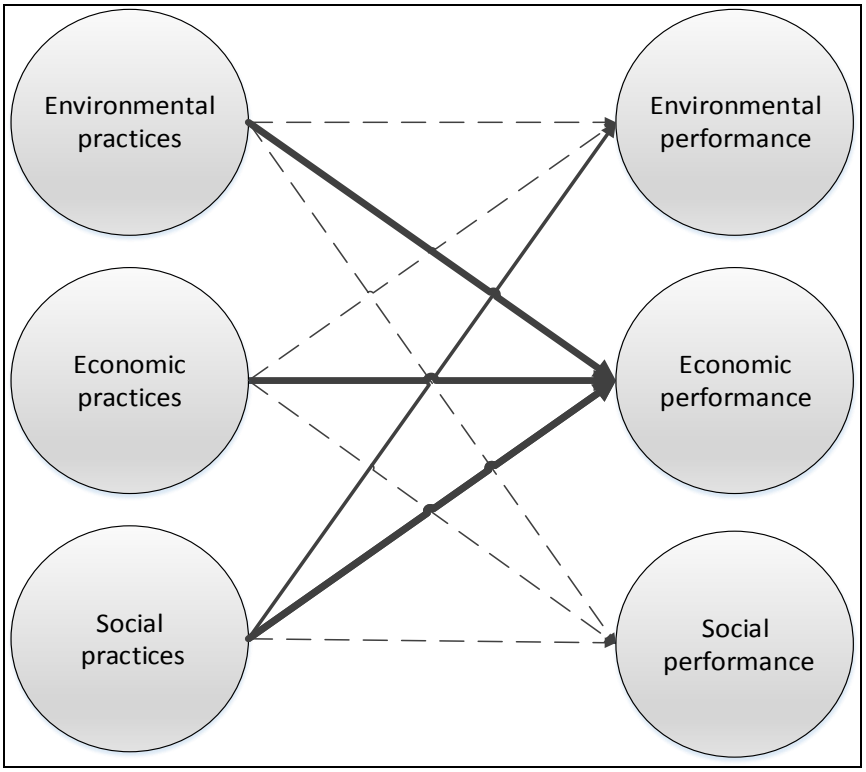

Figure 7: Summary of associations between the standard sub-criteria of sustainability practices and performance (environmental, social, economic)

Regarding the interesting associations of economic and environmental aspects of sustainability, it is found that the bulk of research is concerned with the effects of implementation of environmental practices on the economic performance of an SME, whereas inverse association still remains under researched. It is also worth to note the lack of relevant research conducted in the "social practices-social performance" and "environmental practices-environmental performance" connections.

From a practical perspective, it would also be beneficial to understand the correlation among the sub-constructs of economic, environmental and social practices and performance by revealing most frequently used sustainability

practice/performance micro variables in the models used in the prior researches. However, most of the literatures used varied sub-constructs with respect to sustainability practices and performance. Therefore, examining meaningful correlation among the variables at this level is impossible.

The reporting of the most frequently used criteria for achieving sustainability in prior research is important in order to judge the practical implications of these researches. Additionally, this study facilitates identify means for achieving sustainability through transforming business processes.

This review reveals that environmental and social practices are more frequently utilized in applied research to relate with sustainability performance of SMEs, when compared to economic practices. Among the environmental practices, waste management through reduce, re-use, recycle of resources (materials, water etc.), reduction energy/fuel consumption to reduce greenhouse gas emissions and pollutants are mostly emphasized. This finding is at large part in agreement with research conducted in larger companies (see section 1). Resource and energy efficiency could be achieved through the replacement of older equipment, emissions can be controlled via suitable filters, as suggested in the literature. Elimination in the production of toxic substances or provision for producing products that require minimal consumption of hazardous materials is the desired way for adopting green manufacturing. Green supply chain management has also been adopted through green purchasing (e.g., by choosing suppliers that provide eco-friendly materials and services), eco-design (e.g., by designing products through ensuring that the environmental consequences of the product's entire life cycle are known before its production and distribution), reverse logistics (i.e. moving products from the consumption point to the company's manufacturing sites in order to recycle, reuse, repair or remanufacture) and environmental collaboration with suppliers (e.g., through formal/informal collaboration activities with the objective of improving or solving environmental problems).

Other less frequently provided suggestions as reflected in prior research are the SMEs' initiatives to go beyond the standard environmental legislations and requirements, and acquire accreditation (e.g. ISO 14001, EMAS) from accrediting authorities. Provision of staff training on environmental issues and establishment of standardized procedures for environmental and energy audits are other suggestions in the prior studies. Environmental actions targeted to inform the policymakers, public

and customers on the SMEs' environmental performance could include the communication of these achievements through various means; these may include circulated environmental sustainability reports, e.g., through their website or relevant sustainability reporting platforms (e.g. the GRI platform), the sponsoring of public health activities, or by obtaining customers' views on green product ideas. Provision for specific staff responsible for the company's environmental management activities is also a useful suggestion, as identified by this research.

However, besides identified similarities with larger companies, there are also distinct differences regarding the most frequently emphasized environmental practices/performances from SMEs perspectives. For example, cooperation with stakeholders, external environmental audits and land use reduction have been much less identified in SME literature in comparison to research on large enterprises. Regarding interactions with stakeholders, relevant literature has identified lack of support and guidance from regulatory authorities on implementing sustainability in SMEs (*Hasan, 2016*; *Ghazilla et al.,* 2015), with more attention being currently focused towards large enterprises. It is widely recognized that pressures for SMEs to implement sustainability practices is mainly from their customers, most of them being large multinational companies.

Also, accreditation, both more standard, such as ISO 9001 and ISO 14001, or more specialized certifications (e.g. SA 8000 for social sustainability) have not received attention comparable to larger companies. One reason for this is the high costs of certifications, costs that can be more easily handled by large companies (*Ghazilla et al., 2015*). Another issue that should be further pursued in SMEs is that of cultivation of an environmental-friendly culture within the company.

The social aspects of sustainability practices in SMEs are mainly reflected through CSR initiatives such as the implementation and standardization of health and safety policies and practices in the SME, the provision for the well-being and proper working conditions of the employees (including good labor relations, ethical behavior, flexible working hours policies, workforce diversity, provision for employee benefits), the building of long term relationships with the customers and providing training to employees. Donations and charities to the community, e.g. through donations to social causes, philanthropic activities and charitable organizations in the local community the SMEs operate, or sponsoring students has been also widely

proposed. Another venue towards social sustainability is through acquiring of health and safety certifications (e.g. OHSAS 18001).

Regarding the social aspect of sustainability, differentiations with larger companies mainly include the less emphasis on discrimination and diversity issues as well as the stakeholder involvement on behalf of SMEs, in comparison to larger enterprises.

The economic performance is usually measured through either objective measures such as the growth in profit, market share, turnover and return on investment (ROE), or via more subjective measures, e.g. measurements based on the company's image to customers and general public. The economic indicators are most often suggested to be compared with the competition.

3.3 Methods for Sustainability Analysis (RQ2)

The findings for the research question on methods being used for analyzing the correlation between sustainability practices and performance is demonstrated in the following paragraphs (RQ2). Table 5 shows the list of statistical methods used in prior research as depicted in the 58 selected papers.

Methodology	Frequency	Percent	Cumulative Percent
Covariance-based SEM	19	25.3	25.3
Multiple linear regression	18	24.0	49.3
PLS-SEM	8	10.7	60.0
EFA	8	10.7	70.7
Correlation analysis	8	10.7	81.3
Multiple non-linear regression	3	4.0	85.3
ANOVA	3	4.0	89.3
MANOVA	2	2.7	92.0
PCA	2	2.7	94.7
Cluster analysis	1	1.3	96.0
X^2-test	1	1.3	97.3
t-test	1	1.3	98.7
CFA	1	1.3	**100**
Total	**75**	**100**	

Table 5: Descriptive statistics based on the statistical method utilized for the analysis of collected sample (Note: Results add up to more than 58 SMEs because multiple responses were present)

According to these results, published papers have utilized 13 modeling techniques in total for examining associations between SMEs' sustainability drivers and performance, as well as relations of the latter with other SMEs performance indicators, such as economic performance. The majority of these modeling techniques involve the (covariance based) structural equation modeling (25.3%) and multiple linear regression (24%). A significant amount of analyses (10.7%) also involve the application of partial least squares structural equation modeling (PLS-SEM), a newly proposed SEM approach that differs from the standard covariance-based structural equation modeling (*Hair et al., 2017*), with basic difference being that of PLS-PM not fitting a common factor model to the data, but instead fitting a composite model (*Hanseler et al., 2014*). Same percentages are also found for implementing more common methods such as exploratory factor analysis (EFA) and correlation analysis. There are also more scant attempts in fitting non-linear regression models to such data (4%). Analysis of variance (ANOVA), multivariate analysis of variance (MANOVA) and principal component analysis are also used in a few papers. Finally, an interesting observation is that a few papers utilize more than one method for carrying out the analysis.

Table 6 presents a list of the software used for the statistical analysis and modeling.

Statistical program	**Frequency**	**Percent**	**Cumulative Percent**
SPSS	21	33.9	33.9
Not mentioned	18	29.0	62.9
AMOS	10	16.1	79.0
Smart PLS	8	12.9	91.9
LISREL	2	3.2	95.2
WinBUGS	1	1.6	96.8
Warp PLS	1	1.6	98.4
V PLS	1	1.6	**100**
Total	**62**	**100**	

Table 6: Descriptive statistics based on the statistical software utilized for the analysis of collected sample (Note: Results add up to more than 58 SMEs because multiple responses were present)

The majority of the papers under investigation utilize SPSS statistical software (*IBM Corp. Released, 2017*), followed by the AMOS software (*Arbuckle, 2014*).

Specifically, the 33.9% of examined papers utilize SPSS software for conducting the statistical analyses, whereas a 16.1% uses AMOS software with the purpose of running and fitting structural equation models to the data. LISREL (*Jöreskog and Sörbom, 2015*), an alternative software for fitting SEM models is less frequent used by researchers in the field (3.2%).

However, it is rather surprising to find that a large number of papers (29%) do not provide any information at all regarding the software utilized for performing the statistical analysis. Another interesting outcome from these results, is that Smart PLS (*Ringle et al., 2015*) is the most commonly used software for running PLS-SEM (12.9%).

3.4 Proposed sustainability practice/performance measurement framework

Most of the prior research intends to reveal the correlations between - environmental and social practices with economic performance; and social practices with environmental performance. However, as indicated in recent research (*De et al., 2020; Dey et al., 2020a; Dey et al., 2020b; Malesios, 2018a; Malesios, 2018b*) understanding the correlation of every possible sustainability practice and performance has immense value. Therefore, there is strong need for more robust framework to enable analysis of the SMEs sustainability practices in order to enhance their sustainability performance. Figures 8, 9, and 10 show economic, environmental and social practice and performance frameworks respectively showing the criteria as identified in the literatures that have been reviewed for this research. SMEs may select practice and performance criteria from the proposed frameworks (figures 8, 9 and 10) in line with their business requirements and derive current state of sustainability using most suitable method for analysis. This will enable them to objectively derive sustainability improvement measures.

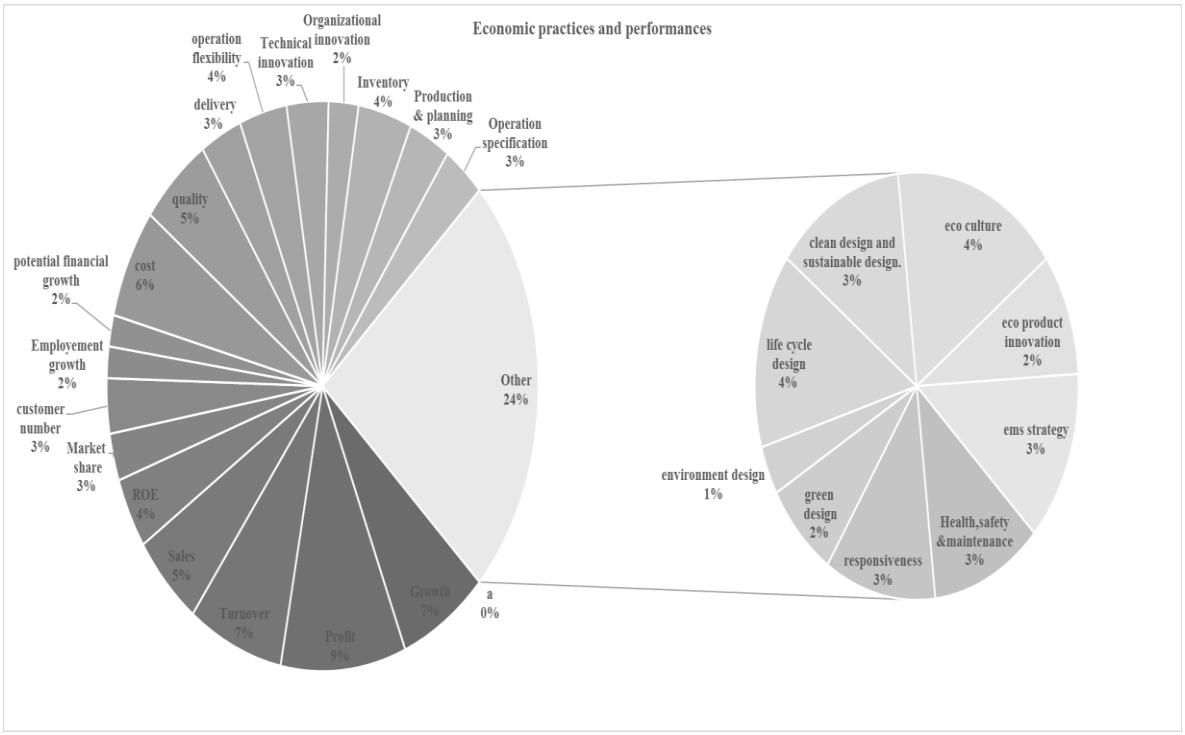

Figure 8: Criteria presented in the SMEs' economic practice and performance

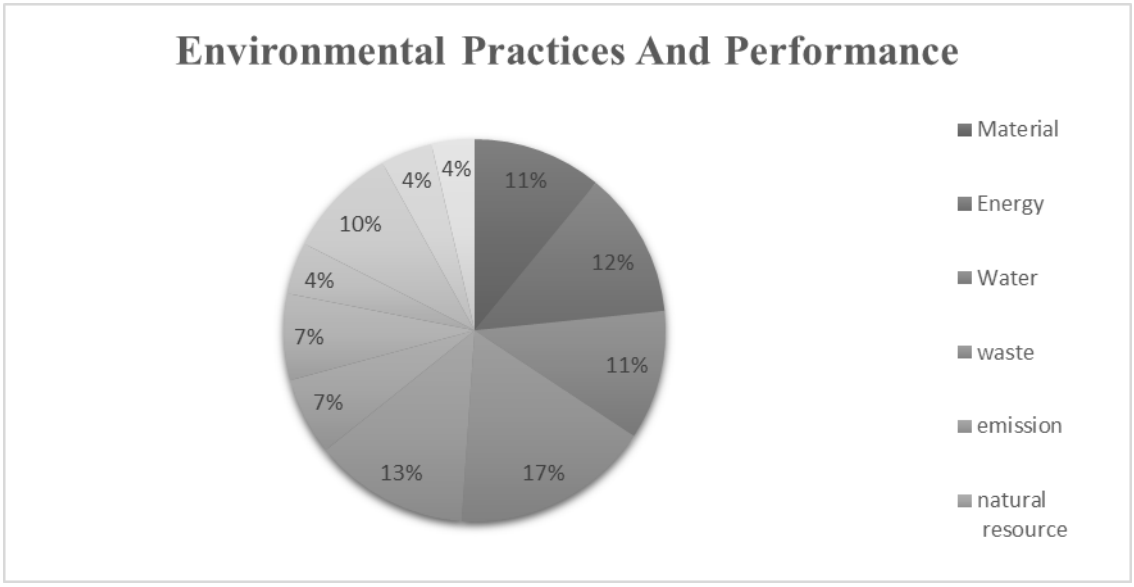

Figure 9: Criteria presented in the SMEs' environmental practice and performance

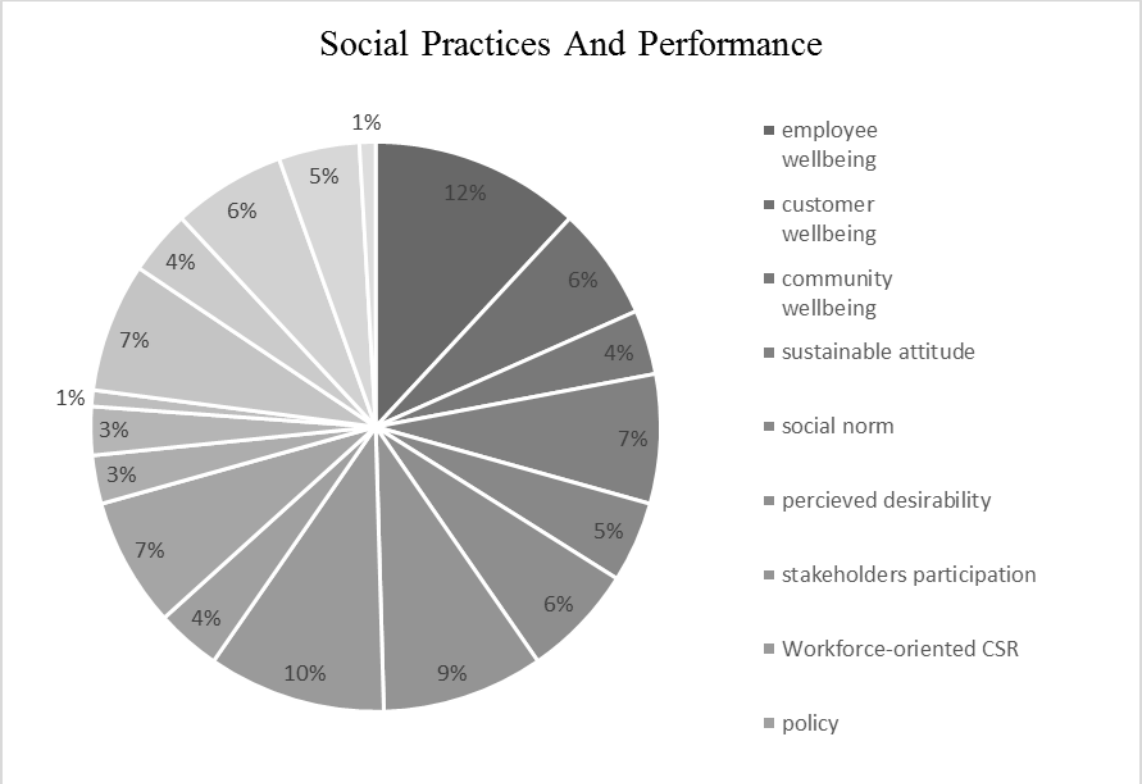

Figure 10: Criteria presented in the SMEs' social practice and performance

The proposed framework also enables SMEs to analyse effect of pressures/drivers for the implementation of sustainability practices in SMEs. Generally pressures come from government, environmental pressure groups and/or other stakeholders. Pressures/drivers can act as a potential moderator for implementing sustainability practices. The barriers (constraints) that SMEs face due to various internal and external uncertainties can act as a mediator for the association between sustainability practices and performance. Although the concept of barriers is under-researched in the case of SMEs' sustainability modeling - as revealed by the current analysis - the topic is extensively investigated in the case of large companies (e.g., *Jabbour et al., 2016; Abdul-Rashid et al., 2017*) and theoretically debated for SMEs (*Álvarez Jaramillo et al., 2019*), hence imposing the need for further investigation. These barriers may include for instance, the lack of information, regulations and legislation barriers, costs and certain attitudes of SMEs managers/owners against implementing sustainability practices.

4 Conclusions and Recommendations

SMEs business sustainability is one of the major concerns of any industry. Sustainability constitutes of economic, environmental and social aspects of business. Due to intense competition and lack of support from regulatory authorities and customers often SMEs prioritize economic aspects providing less emphasis on environmental and social initiatives. This may cause serious negative impact on the overall sustainability performance of the specific industrial supply chain and in turn entire region. To combat this issue recently several researches have been undertaken to model SMEs' sustainability practice and performance associations using criteria in different layers.

This paper reviews the prior literature on the sustainability modeling approach for SMEs to reveal most researched sustainability practice and performance criteria (RQ1) in SMEs. In addition, correlation between them, and methods that are used to derive their relationship along with the software deployed for the analysis (RQ2) are determined. Finally, a generic framework for analysing causal relationships between sustainability practice and performance is also proposed.

This review reveals that most of the prior research emphasizes on deriving the correlation between environmental and social practices with economic and environmental performance in SMEs' businesses(e.g., *Aragon-Correa et al., 2008; Again et al., 2013; Jayeola, 2015; Lee et al., 2012; Zeng et al., 2011*). The aspect of social performance, however, is at a large part missing, signifying an important difference in comparison to larger companies. Innovation, recycling, customers' oriented approach, lean, CSR, and environmental friendly businesses are considered as the criteria for environmental and social practices. On the other hand, financial, operational, cost, profit, market competitiveness, quality and growth are considered as criteria for economic performance (see, e.g., *Anggadwita and Mustafid, 2014; Cantele and Zardini, 2018; Cherrafi et al., 2018; Jayeola, 2015; Maletic et al., 2016*). Whereas, various green targets (e.g., through energy and resource efficiency, waste and emission reduction) are included as environmental performance criteria (e.g., *Aragon-Correa et al., 2008; Larrán Jorge et al., 2015; Li et al., 2017*).

A large proportion of the papers, which are reviewed in this secondary research, study the correlation between environmental and social practices with economic and environmental performance. It is also of interest to note that although

the "environmental practices-economic performance" association is frequently researched and found to be important in most cases, there is much less attention in the "economic practices-environmental performance" association (few exceptions are *McKeiver and Gadenne, 2005; Singh and Kumar, 2017*). This implies the need of studies with focus on revelaing the relationship between economic practices and sustainability performance. Very few studies look into the correlations between pressures from customers and policymakers with sustainability practices (*Aboelmaged, 2018; Dey et al., 2018a*), correlation of drivers for environmental and social practices with only environmental and social (but not economic) practices (*Singh and Kumar, 2017*), and theory of planned behavior with only environmental practices (*Rezai et al., 2016; Sánchez-Medina et al., 2014*). These associations may also provide a scope for future research.

Majority of the papers that are reviewed in this study focus on the following associations between sustainability practices and performance constructs:

- Correlation between economic practices and economic performance (whereas association between economic practices and environmental/ social performance is currently underesearched).
- Correlation between environmental practices and economic performance (less research has been focused on the effect of environmental practices on the environmental and social performance).
- Correlation between social practices and environmental/ economic performance (with less research focused on associations between social practices and social/ innovation performance).
- Surprisingly associations between green practices and operational performance are underesearched, however there are studies investigating the correlation between green practices and environmental/ green performance.
- Correlation between innovation practices and economic, environmental and social performance (with a very few researches examining the association between innovation practices and innovation performance).
- Few researches are concentrated on the association between operational practices and economic performance.

- Few researches are concentrated on the association between lean practices and sustainability/ green performance.
- Correlation between eco-efficient practices and economic, environmental performance.
- Correlation between entrepreneurial orientation and economic performance (with less research focused on the effects of entrepreneurial orientation on the environmental and social performance).

The reviewed papers further reveal that structural equation modeling and multiple linear regression are the most frequently used methodologies to derive associations between independent and dependent variables for SMEs sustainability analysis (see, e.g., *Anggadwita and Mustafid, 2014; Agan et al., 2013; Cherrafi et al., 2018; Cantele and Zardini, 2018; Li et al., 2017; Masocha and Fatoki, 2018*). This, at a large part, coincides with research on large companies. SPSS and AMOS are widely used statistical analysis software for revealing correlation between the variables for sustainability analysis of SMEs (e.g., *Dey et al., 2018a; Epoh and Mafini, 2018; Masocha and Fatoki, 2018; Panwar et al., 2016*). Smart Partial Least Square (PLS) is the next popular software for statistical analysis in deriving correlation between variables. Additionally, this study reveals that most of the statistical modeling approaches for sustainability analysis are applied in manufacturing SMEs (e.g., *Cherrafi et al., 2018; Dey et al., 2018a; Idris et al., 2017; Sajan et al., 2017; Urban and Naidoo, 2012*). Another interesting finding is that till date most of the studies on SMEs sustainability have been performed using data from European and Asian SMEs compared to North and South American, African and Australian (*Caputo et al., 2018; Dey et al., 2018a; Jayeola, 2015; Li et al., 2017; Malesios et al., 2018b; Rashid et al., 2015*).

SMEs must consider all possible sustainability practices and performance criteria for their robust analysis with the involvement of the concerned stakeholders (e.g. SMEs' representatives and policymakers). Additionally, both pressures and barriers for achieving sustainability targets with respect to economic, environmental, and social aspects need to be identified for the analysis. Typical pressures from customers, regulators and top management may be included. These will help to develop a robust framework for analysis through formation of various hypotheses. In

line with the hypotheses testing framework a detailed questionnaire is formed to gather data from the sample SMEs and the data is processed using statistical models through related software. The outcome in the form of correlation between sustainability practice and performance reveals the measures that policymakers and individual SME must undertake to achieve enhanced sustainability.

Additionally, the utilization of moderating/driving factors for sustainability management in SMEs is also something that has to be examined in more depth since that the current research identified limited work on these relationships. Moreover, our proposed framework for future research in the modeling of sustainability practices/performance, based on the findings of this analysis, may add to the previous proposals and serve as a synthesized modeling framework towards a unified and universal examination tool for the associations between the various practices and performance (RQ2).

This review paper has both theoretical and practical implications. Theoretically, it provides a comprehensive framework to undertake SMEs sustainability analysis following a structured approach. This identifies all the possible variables that need to be included in the analysis. Additionally, it reveals correlations between sustainability practice and performance criteria that have been observed in prior research enabling future research to compare their findings with prior works. Further, this study instills confidence to researchers on which statistical model and software are being mostly used for similar analysis with good understanding on where to find the relevant articles. Practically, it facilitates both policymakers and SMEs to adopt sustainability analysis and contribute to achieve greener environment. Finally, we must note the lack of an integrated statistical model for the sustainability framework in SMEs. We are attempting to fill this gap through our proposed sustainability practice/performance criteria measurement as visualised in Figures 8-10, which is based on the addition of specific under-researched elements (identified by our literature review) to the standard "practice-performance" modeling framework.

The study scopes to review only statistical modeling approaches. However, SMEs sustainability review study could be extended to other modeling approaches such as multiple criteria decision making, various qualitative models etc. This would add newer dimension to the review work on the topic. Another limitation of the current study derives from the use of the specific research design for the identification of relevant publications. For instance, publications may be underrepresented due to

the utilization of certain key words that may not be included in the title or abstract of papers in the field that mobilize different terminology.

Acknowledgements
This research has received funding from the European Union's Horizon 2020 research and innovation programme under the Marie Sklodowska-Curie Grant Agreement No. 788692.

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APPENDIX

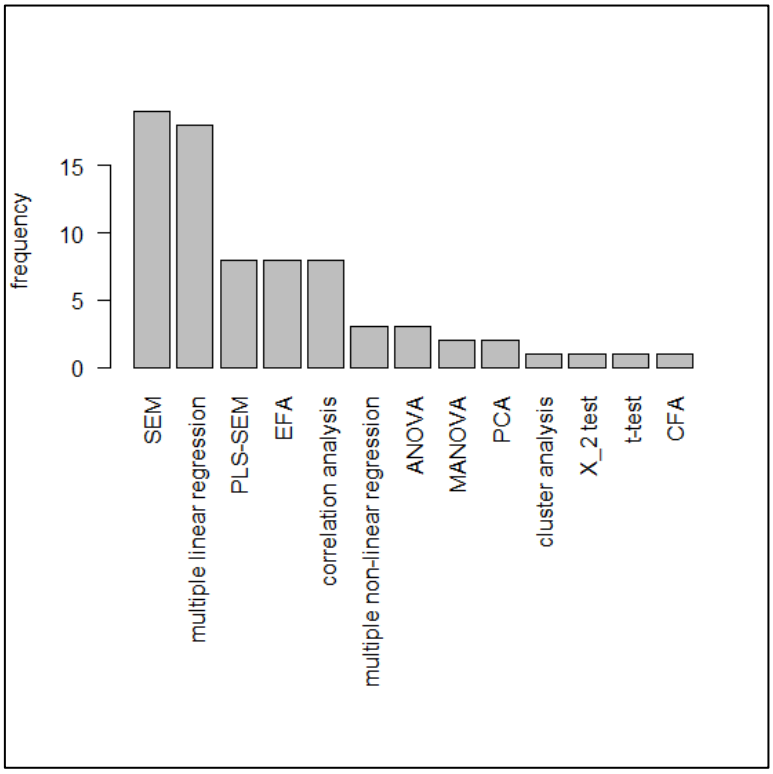

Figure A1: Breakdown of articles based on the statistical method utilized for the analysis of collected sample

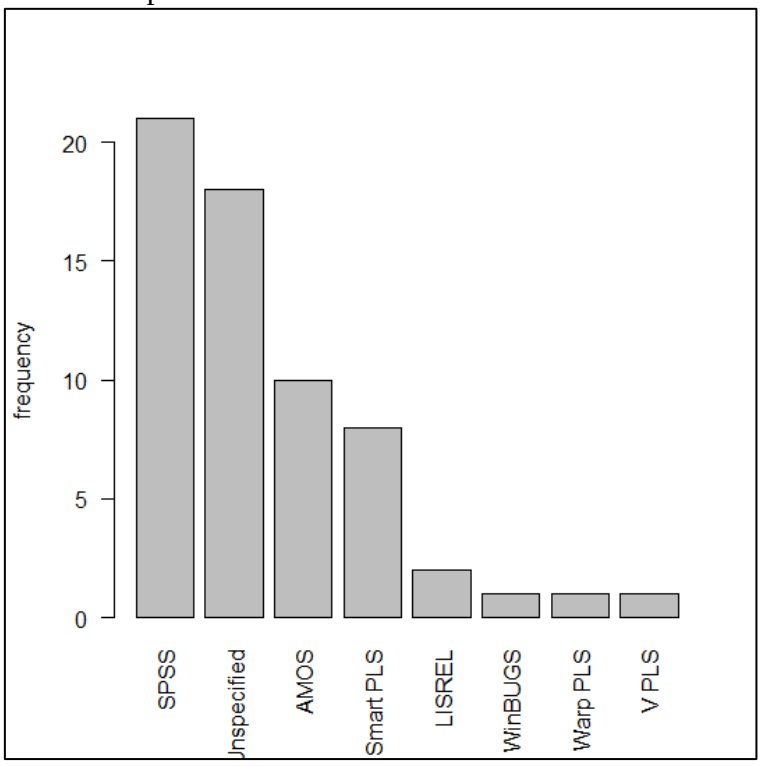

Figure A2: Breakdown of articles based on the statistical software utilized for the analysis of collected sample

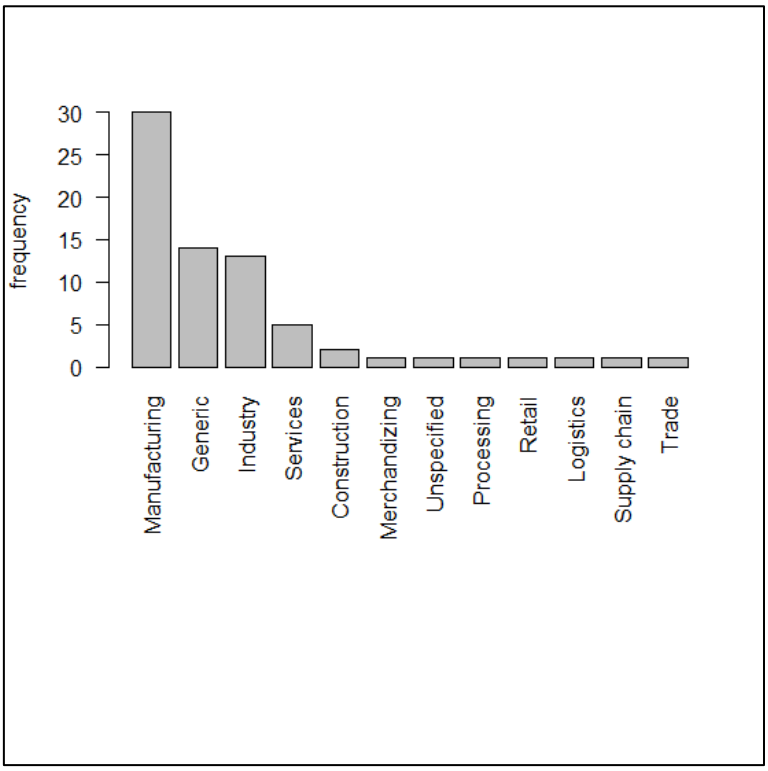

Figure A3: Breakdown of articles based on the industry type of collected sample

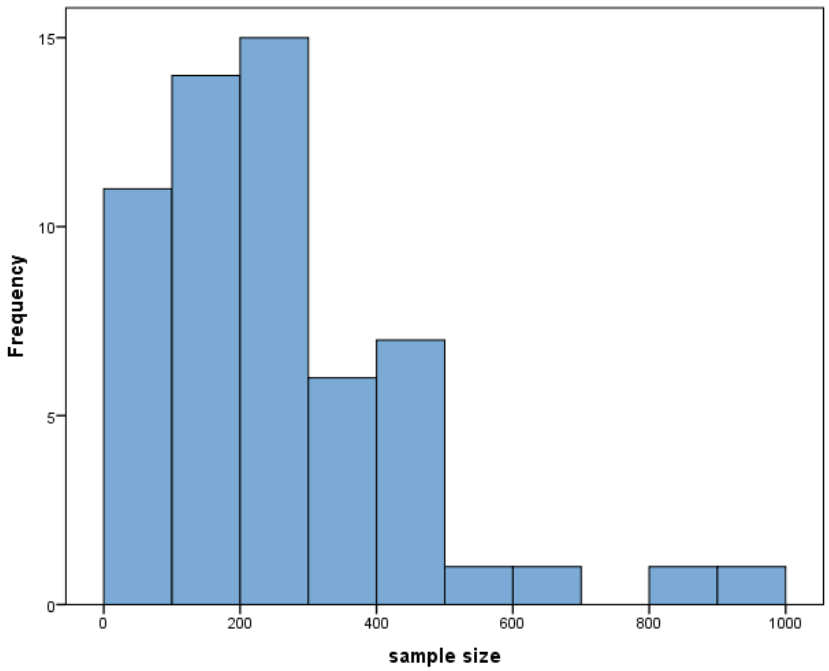

Figure A4: Histogram of sample size collected from SMEs

COUNTRY	CATEGORY OF INDUSTRY	CRITERIA OF THE DEFINITION
India	Tiny	<2.5 million Rs. of investment in plant and M/C
	Medium	<1,000 million Rs. of investment in plant and M/C
	SSI	<10 million Rs. of investment in plant and M/C Small
Australia	Manufacturing services	enterprises <100 employees Medium enterprises 20 employees
China	SME	Depends on product group usually <200 employees
France	SME	10-499 employees
Indonesia	SME	<100 employees
Japan	Manufacturing	<300 employees or asset capitalization <100 million yen
	Wholesale trade	<50 employees or asset capitalization <30 million yen
	Retail trade and services	<50 employees or asset capitalization <10 million yen
Korea	Manufacturing services	<300 employees
		<20 employees
Malaysia	SMIs	<75 full time workers or with a shareholder fund of
		<RM 205 millions
	SIs	Manufacturing establishments employing between 5 and 50 employees or with a shareholders fund up to RM 500,000
	MIs	Manufacturing establishments employing between 50 and 75 employees or with a shareholders fund between RM 500,000 to RM 205 million
Singapore	Manufacturing services	<SS 12 million fixed assets
China (Taipei)	SMEs	<100 employees
		In manufacturing, mining and construction-invested capital is <NT$40 millions or the number of regular employees not to exceed 200
Thailand	Labor intensive sectors	
	Capital intensive sectors	<200 employees
UK	SME	<100 employees
USA	Very small enterprises	No universal fixed definition
	Small enterprises	<20 employees
	Medium enterprises	100-499 employees
Vietnam	SME	20-99 employees
		No fixed definition, generally <200 employees

Table A1: Definition of SMEs in different countries (adopted from Thakkar et al., 2009)

Study	Description
McKeiver and Gadenne (2005)	*McKeiver and Gadenne (2005)* examine the various external, moderating and internal factors that may influence the implementation of an environmental management system within a limited sample of SMEs in Australia. The authors simultaneously test the effects of external, moderating and internal factors on the two dependent variables (levels of environmental management system implementation), with size and industry type suggested as main drivers of these factors.
Aragon-Correa et al. (2008)	*Aragon-Correa et al. (2008)* hypothesize and empirically validate a conceptual model that examines the associations between proactive environmental practices, environmental performance and firm performance. The authors argue that firms with proactive environmental and eco-efficient strategies show a positive and significant relationship with firm's financial performance.
Rahman et al. (2010)	*Rahman et al. (2010)* examine the adopted effects of lean management practices on manufacturing organizations in Thailand (including SMEs) on firms' operational performance. Principal components analysis was utilized to reduce dimension of lean practices, resulting in three basic components, these were "just in time (JIT)", "waste minimization" and "flow management". The associations between the obtained factors were analyzed through regression modeling. The results indicated that all three lean constructs are significantly related to operational performance.
Zeng et al. (2011)	*Zeng et al. (2011)* model the relations between the drivers of environmental management and the economic/environmental performance of SMEs. In particular, the study focuses on the investigation of correlations between environmental management and economic performance for Chinese manufacturing SMEs at different pollution levels. The results showed that SMEs of different pollution levels have significant differences in the relationship of driving forces and their economic/environmental performance.
Urban and Naidoo (2012)	*Urban and Naidoo (2012)* examine associations between operations skills (i.e. operational practices) and (economic) sustainability of SMEs. Methodology utilized included factor analysis to identify relevant factors in

	terms of operations skills and correlational analysis in order to test the hypothesized relationships. The obtained results indicated a positive and significant association between operations skills and (economic) sustainability of SMEs.
Jamian et al. (2012)	*Jamian et al. (2012)* propose a theoretical conceptual model that associates 5S practices (comprising of the following concepts: "sort", "set in order", "shine", "standardize" and "sustain") with sustainability of manufacturing SMEs.
Vinodh and Joy (2012)	*Vinodh and Joy (2012)* examine interrelations between the three sub-constructs of sustainability in SMEs, i.e. social, environmental and economic latent constructs, utilizing a sample of 50 manufacturing SMEs in India. The data were analyzed through structural equation modeling, to show that most significant associations are those between environmental sustainability and economic sustainability constructs.
Lee et al. (2012)	*Lee et al. (2012)* tested effects of the green supply chain management (GSCM) practices on the business performance. The study uses confirmatory factor analysis to test the relationship. The results indicate that business performance will be improved when GSCM enhances operational efficiency.
Agan et al. (2013)	*Agan et al. (2013)* proposed and validated a model to investigate the effects of drivers of environmental processes on the latter and in turn the effect of environmental processes on SMEs' (economic) performance. The most influential driver was the driver of "Expected Benefits". The hypothesized model was fitted to the collected data through the use of SEM.
Yusuf and Dansu (2013)	*Yusuf and Dansu (2013)* examine the effect of business risk management on SMEs' sustainability in Nigeria. The data analysis and hypotheses testing performed with the use of Chi-square test and descriptive statistics, revealing that standard risk management strategy by SMEs will result to an increase in their sustainability.
Turyakira et al. (2014)	The primary objective of the study by *Turyakira et al. (2014)* was to identify and empirically test the corporate social responsibility factors influencing the competitiveness of SMEs in Uganda. In doing this correlations were assessed using structural equation modeling. The empirical results of this study showed that workforce-oriented CSR activities, society-oriented CSR activities, market-oriented CSR activities and regulated CSR activities significantly influence the competitiveness of SMEs in the country.
Anggadwita and Mustafid (2014)	*Anggadwita and Mustafid (2014)* propose a conceptual framework for measuring the performance of SMEs. Among the various factors suggested by the authors to measure firm performance is sustainability of SMEs. For

	the measurement of the sustainability factor, two items are suggested, those of growth and profitability. A multiple linear regression analysis model is fitted to the collected data using as the dependent variable the performance of selected SMEs, whereas as independent variables the four constructs for measuring firm performance have been utilized (factor scores). The results of model fit indicated that only the entrepreneurial aspects and the competence of human resources variables were statistical significant predictors of firm performance.
Akhtar et al. (2014)	*Akhtar et al. (2014)* attempt to link sustainability of SMEs in Malaysia with the concept of social capital (*Nahapiet and Ghoshal, 1998*; *Putnam, 2001*). By applying regression modeling, it has been found that social capital has a significant influence on the sustainability of the companies.
Bourlakis et al. (2014)	*Bourlakis et al. (2014)* apply analysis of variance in order to investigate the effects of food supply chain SMEs' characteristics, such as their size, on the sustainable performance of the latter. The main finding of the study is that the Greek food supply chain members over perform or underperform in relation to their sustainability performance, according to their size.
Battaglia et al. (2014)	*Battaglia et al. (2014)* focus on identifying associations between the adoption of corporate social responsibility (CSR) and competitiveness performance among SMEs operating in the fashion industry, in France and Italy. The results of the paper show a significant correlation with regard to the innovation process, both from the technical and the organizational point of view, and the CSR performances.
Sánchez-Medina et al. (2014)	The objectives of *Sánchez-Medina et al. (2014)* are to clarify the attitudes of of Canarian small and medium-sized companies about taking environmental measures, and try to demonstrate whether there is a relationship between the factors related to the theory of planned behavior and the intention to take these measures. Results through SEM modeling revealed positive associations between the dependent and independent factors of planned behavior.
Hami et al. (2015)	*Hami et al. (2015)* attempt to identify relationships between sustainability practices and economic sustainability, utilizing as mediator the innovation performance construct. The authors adopt structural equation modeling (specifically the PLS-SEM methodology) to find that internal sustainability practices have a positive significant effect on economic sustainability. The mediator of process innovation has been found to partially mediate this

	association. An interesting finding of the study is that more environmentally friendly products and business operations as well as being socially responsible may directly lead to negative economic results.
Jansson et al. (2015)	In another modeling approach, *Jansson et al. (2015*) assess the effects of two strategic orientations of SMEs, those of market orientation and entrepreneurial orientation, on the structures of sustainability commitment, sustainability practices and management values, based on linear regression modeling. From the evaluation of derived results, it is suggested that the influence of market/entrepreneurial orientation and sustainability practices on commitment to sustainability is significant, implying that firms committed to sustainability see both market and entrepreneurial advantages of sustainability.
Jayeola (2015)	In *Jayeola (2015)* another empirical examination of the relationship between environmental sustainability practices and financial performance of SMEs is found. The financial performance is measured through three items, those of market indicators (revenue and profit) and one accounting indicator (ROE). The independent variables are environmental policy, reduction of consumption, recycling and pollution prevention and control. The main finding from the study is that profit is the best predictor of SMEs financial performance, pollution prevention and control is positively and significantly related to profit and recycling is negatively and significantly related to profit.
Soubihia et al. (2015)	*Soubihia et al. (2015)* analyze how the adoption of a proactive environmental management via green operational practices correlates to the green performance of SMEs.
Tomsic et al. (2015)	*Tomsic et al. (2015)* attempt to analyze the link between corporate sustainability and economic performance. The model was fitted to the data through SEM analysis, to show that corporate sustainability has a significant positive effect on economic productivity of SMEs. The significant effect of process innovation, leadership and EU policy on corporate sustainability has been also verified by the results of the specific study.
Juniarty and Ismail (2015)	*Juniarty and Ismail (2015)* utilize multiple linear regression analysis in order to examine the relationship between the general construct of sustainability and a selection of sub-constructs (namely "Energy consumption", "water consumption", "waste management", "environment preservation", "equality in society" and "noise and emission management"). The authors argue that only three out of 6 sub-constructs of sustainability have positive effect on the latter, those being "Water consumption", "Waste management" and "Noise and emission management".

Larrán-Jorge et al. (2015)	*Larrán-Jorge et al. (2015)* examine if improved environmental performance encourages the appearance of positive reactions for any company's image and its competitiveness. Using structural equation modeling, different cause effect relations were analysed. The study suggest that environmental performance has a positive, direct and significant influence on competitive performance.
Rashid et al. (2015)	*Rashid et al. (2015)* examine whether firms' resource and capabilities are recognized as firm's strategic weapons to success on reducing carbon footprint using a structural equation modelling approach.
Koe et al. (2015)	*Koe et al. (2015)* perform multiple linear regression analysis in order to examine the potential positive effects of the latent constructs of "sustainability attitude", "social norms", "perceived desirability" and "perceived feasibility" on the latent construct of propensity to sustainable entrepreneurship. The outcome of the analysis performed is that all explanatories had shown a positive effect on the dependent variable, except for the construct of social norms.
Pinget et al. (2015)	*Pinget et al. (2015)* attempt to examine the associations between (technological) environmental innovation of French SMEs and corresponding determinants. To this end, a multinomial logit regression model was fitted, including as dependent variable the binary variable expressing presence or absence of environmental innovation in the company, whereas as independent variables the authors included a series of explanatory variables. Results of the model fit indicated that most significant predictors of environmental innovation are firm size, age and if the firm has exports or belong to a cluster.
Rezai et al. (2016)	*Rezai et al. (2016)* utilize the theory of planned behavior (TPB) to determine the relationships between TPB constructs and the intention to adopt green practices. The results of structural equation modeling indicate that positive attitudes towards sustainability are being embraced by those who are concerned about the environment.
Soto-Acosta et al. (2016)	*Soto-Acosta et al. (2016)* examine for positive relationships between sustainable entrepreneurship and business performance in the case of Romanian SMEs. Business performance was measured in terms of business profitability, business effectiveness and business competiveness. The analysis based on PLS-SEM reveals that sustainable entrepreneurship has come to inherently encapsulate social and economic issues.
Zhou (2016)	*Zhou (2016)* investigates potential factors associated with the implementation of lean practices in SMEs in the

	US. By performing cluster analysis and analysis of variance, the author identifies the major constructs of lean as perceived by SMEs and the most important drivers for implementing lean practices.
Raziq and Wiesner (2016)	*Raziq and Wiesner (2016)* employ SEM to examine the potential positive impacts of management practices on the sustainability performance of manufacturing and service-sector SMEs. The obtained results indicated a significant positive relationship between management practices and sustainability performance.
Habidin et al. (2016)	*Habidin et al. (2016)* through a regression modeling approach determine the relationship between sustainable manufacturing practice (SMP), and environmental performance (EP) in Malaysian automotive industry. The analysis results indicated that only a few of the practices are significant predictors of environmental performance of SMEs.
Suriyankietkaew and Avery (2016)	*Suriyankietkaew and Avery (2016)* investigate the relationships between a total number of 23 sustainable leadership practices (see *Avery, 2005*), that include environmental and social aspects of enterprises' practices and SMEs financial performance. Results from this study indicated that only four out of the 23 sustainable leadership practices employed were statistically significant and had a positive effect on the financial performance of SMEs.
Singh et al. (2016)	*Singh et al. (2016)* propose a performance evaluation approach for the measurement of sustainability in manufacturing SMEs. The study proposes a web-based fuzzy rule based system. The evaluation system is based on a number of metrics (four economic, five environmental and three social metrics) suitable for SMEs.
Stopper et al. (2016)	*Stopper et al. (2016)* extend the traditional three pillar sustainability model (i.e. social, environmental and economic based sustainability) by incorporating the so called "Doughnut model" (*Raworth, 2012*) into the SMEs framework. The authors describe the framework for the proposed model from a theoretical perspective and propose specific indicators for the ecological and social parameters.
Hosseininia and Ramezani (2016)	*Hosseininia and Ramezani (2016)* attempt to establish which social and environmental factors affect the sustainable entrepreneurship in small- and medium-sized enterprises. The authors through correlation and regression analysis examine the effects of 8 social and environmental factors on entrepreneurs' sustainability measurement to find that most significant independent variables were "social supports", "considering the standards", "physical standards of workplace", "staff training"," future of the earth and the environment" and "recycling and human resources".

Maletic et al. (2016)	*Maletic et al. (2016)* studies the relationship between sustainability-oriented innovation practices as well as their effects on particular performance dimensions (i.e., economic performance, quality performance, innovation performance, environmental performance and social performance). An exploratory factor analysis was performed, followed by regression analysis. The empirical evidence suggests that when organizations strongly emphasize sustainability practices they can improve both economic and non-financial performance.
Panwar et al. (2016)	*Panwar et al. (2016)* examine the relationship between a small firm's focus on competing through a differentiation strategy and on competing through a cost-leadership strategy, placing emphasis on environmental engagement. The paper finds that a firm's focus on competing through differentiation strategy is not associated with its level of environmental engagement.
Choongo et al. (2017)	*Choongo et al. (2017)* studied the impact of the different forms of CSR in SMEs in Zambia. The study considered the environmental CSR and social CSR. The study found external factors hardly motivate any role in the CSR implementation. The findings suggest that the internal motivations like financial motivation and moral and ethical motivation positively influenced entrepreneurs engagement in community and environmental CSR activities, but not much of influence of the employee CSR.
Jahanshahi and Brem (2017)	*Jahanshahi and Brem (2017)* studied the top team level relationship between top management teams' (TMT) behaviour integration with their innovativeness and sustainability orientation. Multiple regression analysis is used. Findings suggest that the TMT are more likely to engage in sustainable oriented innovations compared to less sustainability integrated TMTs. The study highlights that younger members, and highly educated TMTs generate more innovation in sustainability in the workplace.
Juárez (2017)	*Juárez (2017)* examines the effects of sustainability practices on the profitability of SMEs, using a variance-based statistical technique focused on SEM, namely the partial least square (PLS) modeling. Main finding from the study is that the social and economic CSR activities have a positive influence on the profitability in SMEs.
Sajan et al. (2017)	*Sajan et al. (2017),* through structural equation modeling and utilizing a sample of 252 manufacturing SMEs in India, investigate the associations between lean manufacturing practices (LMPs) in SMEs and their sustainability performances. The analysis results indicated that lean practices are positively associated with various sustainability performances such as economic, environmental, and social performances. Further, the authors

	argue that environmental sustainability is correlated with economic and social sustainability performances.
Susanty et al. (2017)	In the empirical study of *Susanty et al. (2017)*, the authors test for the potential effects of "internal supply chain practices" on the environmental performance of SMEs in Indonesia. The former construct consists of sub-constructs (dimensions) of "internal environmental management", "green purchasing", "cooperation with the customer", "eco design" and "investment recovery" (see *Zhu et al. 2008a; 2013*). Results of multiple linear regression reveal that not all internal supply chain practices affect in a positive way the environmental performance. In particular, only the "customer cooperation" and "internal recovery" constructs have a positive significance effect on environmental performance for all company type.
Idris et al. (2017)	*Idris et al. (2017)* study the impact of green manufacturing on the environmental sustainability among the manufacturing sector SMEs in Malaysia. The study uses a quantitative approach to study the relationship between green manufacturing, measured by cleaner production and eco-efficiency to environmental sustainability. The results establish that cleaner production has a positive and significant impact on environment sustainability while eco-efficiency does not have a positive and significant impact on environment sustainability.
Singh and Kumar (2017)	*Singh and Kumar (2017)* employ correlation analysis and multiple linear regression to investigate the effect of drivers on green supply chain management on environmental performance in SMEs in India. The analysis results reveal that the society drivers are the most important in the environmental performance of the enterprizes.
Li et al. (2017)	*Li et al. (2017)* examine the effects of factors such as environmental sustainability, international buyer involvement and knowledge integration on business performance. Structural equation modeling applied to the data showed that knowledge integration mediates the performance impact of market-oriented environmental sustainability.
Aboelmaged (2018)	*Aboelmaged (2018)* examines the relationship between the drivers of sustainable manufacturing practices and the competitive capabilities of Egyptian SMEs. Specifically, the paper examines the impact of technological and environmental drivers on sustainable manufacturing practices, and the influence of the latter on competitive capabilities. The author empirically tests the proposed theoretical model by utilizing the partial least squares approach to structural equation modeling (PLS-SEM). This study demonstrates that environmental pressures, management support and employees' engagement predict sustainability practices in Egyptian SMEs.

Cherrafi et al. (2018)	*Cherrafi et al. (2018)* present an investigation of the relationships between lean, green and process innovation practices and green supply chain performance, utilizing a dataset from 374 manufacturing SME enterprises. The authors analyze the data using structural equation modeling combined with ordinary least squares regression modeling. Based on the results of the analysis conducted, the authors argue that there exists a synergetic effect between process innovation, green and lean practices, which subsequently have a significant positive effect on green performance.
Malesios et al. (2018a)	*Malesios et al. (2018a)* assess the relationship between social, environmental and operational practices and performance with financial performance, focusing also on small- and medium-sized enterprises. To achieve this, Bayesian statistical methodology relying on non-linear regression modeling has been used in terms of both model and variable selection with the aim of obtaining valid and robust results. The results indicated that only specific practices and performances focused on environmental, social and operational sustainability seem to benefit an SME‘s economic performance.
Dey et al. (2018a)	In the study by *Dey et al. (2018a)*, a modeling approach for the examination of the potential influences of SMEs individual characteristics, such as turnover, number of staff and geographical location of the SME, on certain motivations and pressures for the companies’ adoption of environmental management and CSR is presented. In most situations, the most consistent and important predictor for adopting EM and CSR practices was the location of the firm, followed by the variable of turnover. The results are analyzed through ANOVA and multivariate analysis of variance (MANOVA).
Epoh and Mafini (2018)	*Epoh and Mafini (2018)* suggest a conceptual model examining interrelations between green supply chain management, environmental performance and supply chain performance, using data collected from South African SMEs. The empirical analysis conducted through the fit of a structural equation model, suggested that there are non-significant associations between environmental performance and two of the green supply chain dimensions utilized (green purchasing and eco-design). Positive and significant associations were found between reverse logistics and legislation as well as between regulation and environmental performance.
Courrent et al. (2018)	*Courrent et al. (2018)* considers sustainability practices as probable mediators in the relationship between

	entrepreneurial orientation and performance, in the context of SMEs. The authors utilize structural equation modeling, using data collected from 406 French SMEs. The main finding of the study is that entrepreneurial orientation has a positive impact on the implementation of sustainability practices for SMEs in France.
Masocha and Fatoki (2018)	*Masocha and Fatoki (2018)* in their study examine the effects of coercive isomorphic pressures on the sustainability practices of SMEs. Structural equation modeling was utilized to analyze the data. Major finding of the empirical study was that coercive isomorphic pressures have a significant impact on all the three dimensions of sustainability.
Caputo et al. (2018)	*Caputo et al. (2018)*, by taking a customer-oriented approach on the topic of sustainability practices and performance of SMEs, apply SEM in order to examine the effects of a set of SME sustainability practices along with the customers' perceptions of sustainability actions on the economic performance of SMEs. The findings show that the adoption of certain sustainability actions influences consumer perceptions, which in turn impacts the economic performance of SMEs.
Aguado and Holl (2018)	*Aguado and Holl (2018)* examine the factors influencing SMEs' environmental attitude. The authors apply a probit regression model that examines the effects of various factors on the SMEs' corporate environmental responsibility. Specifically, the latter binary dependent variable is regressed upon firm characteristics and motivation factors. As an outcome, the study identified geographical differences, as well as significant effects of firm size, type of industry and of several motivation factors.
Mafini and Loury-Okoumba (2018)	*Mafini and Loury-Okoumba (2018*) investigate the relationship between green supply chain management activities, operational performance and supply chain performance in manufacturing SMEs. Four green supply chain management activitieswere examined as predictors of operational performance, and all found to have a positive effect on the latter. Empirical analysis and hypotheses testing was conducted through structural equation modeling.
Cantele and Zardini (2018)	*Cantele and Zardini (2018)* examine the relationship between sustainability practices and financial performance of SMEs, through mediation effects of several constructs, such as the organizational commitment, reputation, customer satisfaction and competitive advantage. Sustainability practices are measured through social,

	environmental, economic and formal practices, whereas SMEs' financial performance is measured through a single item. The hypothesized model is tested via structural equation modeling. The authors find that the social, economic and formal practices dimensions of sustainability positively affect competitive advantage, mediated by corporate reputation, customer satisfaction and organizational commitment.
Masocha (2018)	*Masocha (2018)* utilized a total of 208 self-administered questionnaires distributed to South African SME owners and managers and subsequently analyzed utilizing SEM. The aim was to investigate the potential effects of constructs such as "innovation firm performance", "ecological firm performance" and "social firm performance" on the latent construct of environmental sustainable development. Research results showed that all three constructs exhibited positive significant association with the sustainability performance of SMEs.
Sarango-Lalangui et al. (2018)	*Sarango-Lalangui et al. (2018)* investigate whether SMEs in Ecuador are involved in the adoption of sustainable practices as well as see if there are significant differences in adoption based on size, sector, and age of the SME. The authors apply exploratory factor analysis to find that the SME managers have a positive and favourable attitude towards sustainability. The main finding of the research is that the size of the companies in the market does not influence the level of implementation of the sustainability practices.
Malesios et al. (2018b)	In another framework, there are attempts in the relevant literature proposing to measure sustainability performance of SMEs in a quantitative way. In particular, *Malesios et al. (2018b)* identify and propose the key practice/performance sustainability indicators, from environmental, economic, operational and social perspective, and subsequently use SEM to develop a regression-type model for deriving sustainable supply chain performance of specific SME through sampling (see also *Shibin et al. 2017* and *Kamarudin and Aslan 2017* for similar approaches in the relevant literature).

Table A2: Content analysis of papers related to SMEs' sustainability variables.

Study	Sustainability practices (Independent)	Sustainability performance (Dependent)	Modeling Method	Software	Country	Sector	Sample size	Web of science	Scopus	Google Scholar
Anggadwita and Mustafid (2014)	Entrepreneurial aspect/Competence of human resource/Innovativeness/Sustainability	Organizational performance	Multiple linear regression	SPSS software	Indonesia	Merchandizing	35	N	N	Y
Aboelmaged (2018)	Technology infrastructure/ technology competence/ environmental pressures/ environmental regulations/ sustainable manufacturing practices/ management support/ employees' engagement	Cost/quality/ delivery/ flexibility	PLS-SEM	SmartPLS 3.0 software	Egypt	Manufacturing	238	Y	Y	Y
Agan et al. (2013)	Drivers of environmental processes (Customer Influence/ Regulation/ Moral and Social Responsibility/ Firm's Hard Benefits Expectations/ Firm's Soft Benefits Expectations) Environmental processes (Waste Treatment/ Reduction/ Recycling within the Firm/ Design/ Environmental Management) System	Economic performance	SEM	AMOS 16	Turkey	Manufacturing	500	Y	Y	Y
Akhtar et al. (2014)	Social capital	Sustainability criteria-environmental	Factor analysis/ Multiple	SPSS 21.0	Malaysia	Manufacturing and Services	171	N	N	Y

		, social and economic practices	regression analysis							
Aguado and Holl (2018)	Motivation factors (client's demands, business opportunity, competitors, public support)/ firm characteristics (size, type of sector)	Corporate environmental responsibility	Probit regression model	Not mentioned	Spain, Norway	Service, manufacturing, industry	800	N	Y	Y
Aragon-Correa et al. (2008)	Environmental strategies (Innovative preventive practices, eco-efficient practices, shared vision, stakeholder management, strategic proactivity)	Economic performance	SEM	LISREL 8.3	Spain	Automotive repair	108	N	Y	Y
Battaglia et al. (2014)	CSR practices (formal, environmental-related, workplace-related, community-related, marketplace)	Competitive performance (Innovation, market, intangible)	Correlation analysis	Not mentioned	Italy/France	Fashion industry	213	N	Y	Y
Bourlakis et al. (2014)	Size of company (micro, small, medium)	Sustainability performance measures (relating to: consumption, flexibility, responsiveness, quality, total supply chain)	ANOVA	Not mentioned	Greece	Food supply chain sector	997	Y	Y	Y
Cherrafi et al. (2018)	Lean manufacturing, green practices, process innovation	Green supply chain performance (Economic	SEM/ Multiple linear regressio	SPSS 19	Morocco, South Africa, Germany,	Manufacturing	374	Y	Y	Y

		efficiency, Performance, integration, collaboration, cost, value creation and sustainability)	n		France, Italy, Spain, Sweden, Finland, USA, Austria, Brazil, Malaysia, India					
Choongo et al. (2017)	External CSR motivation factors, internal CSR motivation factors, control variables (the owner's age, education and gender, firm size and firm age)	CSR practices	exploratory factor analysis, confirmatory factor analysis	Not mentioned	Zambia	Trading and service sector	221	Y	Y	Y
Caputo et al. (2018)	Sustainability practices and actions ("Firms' participation in sustainability organizations"; "Firms' sharing of social reports or equivalent documents"; "Quantity of firms' sustainability-based advertising"; "Amount of information about sustainability actions and strategies shared by firms via web pages" and "Numbers of firms' projects, plans and strategies based on consumer participation")	Economic performance (revenues)	SEM	Not mentioned	Italy	Various sectors	175 SMEs/1137 customers	N	Y	Y

Cantele and Zardini (2018)	Sustainability practices (social, environmental, economic, formal practices)/ Mediators (organizational commitment, reputation, customer satisfaction, competitive advantage)	Financial performance	SEM	Amos software	Italy	Manufacturing	348	N	Y	Y
Courrent et al. (2018)	Entrepreneurial orientation, environmental practices, social practices	Financial performance (profitability, sales); non-financial performance (client's satisfaction, business reputation, and employees' motivation)	PLS-SEM	SmartPLS 2.0 software	France	Major industrial sectors (construction, trade, services)	406	N	N	Y
Dey et al. (2018a)	No Staff , geographical location, membership/certification, business in the community membership/certification	Business' social and ethical responsibility	ANOVA /MANOVA	SPSS software	UK, India	Manufacturing and process	223	Y	Y	Y
Epoh and Mafini (2018)	Green supply chain management (green purchasing, eco designing, reverse logistics, legislation and regulation)	Supply chain performance, environment performance	SEM	SPSS 24.0/ AMOS version 24	South Africa	Manufacturing /Transport and electricity/Gas and water industry/Constructions	65	Y	Y	Y
Habidin et al.	Sustainable manufacturing	Environmental	Factor/C	SPSS 21.0	Malaysia	Automotive	80	N	N	Y

(2016)	practice (Manufacturing process, supply chain management, social responsibility, environment management)	performance	orrelation analysis/ Multiple regression analysis			industry				
Hami et al. (2015)	Sustainable manufacturing practices/ innovation performance	Economic sustainability	PLS-SEM	SPSS software/ SmartPLS software	Malaysia	Manufacturing	150	N	N	Y
Hosseininia and Ramezani (2016)	Environmental factors (Considering the Standards, Considering the physical standards of workplace, Considering the future of Earth and Environment, Considering Recycling) Social factors (Considering social Supports, Considering human resources, Customer orientation, Considering the staff training)	Sustainable entrepreneurship (measured through 4 open-ended questions regarding viewpoints of entrepreneur about sustainability)	Correlation analysis/ Multiple regression analysis	SPSS 22.0	Iran	Food industry	130	N	Y	Y
Idris et al. (2017)	Green manufacturing, cleaner production, eco-effeciency	Environmental sustainability	Correlation/ regression analysis	SPSS 22	Malaysia	Manufacturing	260	N	N	Y
Jansson et al. (2015)	Market orientation (Coordination and planning, External focus, Customer focus)	Commitment to sustainability	EFA/Multiple linear	Not mentioned	Sweden	Not mentioned	450	N	N	Y

	Entrepreneurial orientation (Risk taking, proactiveness, management values, supply of sustainable products, recycling in operations)		regression							
Juniarty and Ismail (2015)	Energy consumption, water consumption, waste management, environment preservation, equality in society, noise and emission in background	Sustainability	Multiple regression analysis	SPSS	Indonesia	Automotive component industry	30	N	N	Y
Juárez (2017)	CSR	Economic, environment and social practice	PLS-SEM	SmartPLS Professional 3.2.6 software	Mexico	Industry/Services	81	N	N	Y
Jayeola (2015)	Environmental policy, reduction of consumption, recycling, pollution prevention and control	Economic performance (Revenue, profit, ROE)	Multiple linear regression	SPSS 21	UK	Manufacturing and industry	98	N	N	Y
Jahanshahi and Brem (2017)	(Top management teams') behavioural integration, control variables (education, age, gender, years of experience)	(Top management teams') Sustainability orientation, innovativeness	Multiple regression analysis	Not mentioned	Iran	Manufacturing	160	N	N	Y
Kamarudin, and Aslan (2017)	Green management (competitive resources, process realization)	Green performance (environmental control, social and economic	SEM	Not mentioned	Malaysia	Manufacturing	281	N	N	Y

		success)								
Koe et al. (2015)	Sustainability attitude, social norm, perceived desirability, perceived feasibility	Propensity to sustainable entrepreneurship	Correlation analysis/ Multiple regression analysis	Not mentioned	Malaysia	Various sectors	404	N	N	Y
Li et al. (2017)	Environmental sustainability, international buyer involvement, knowledge integration	Business performance	SEM	LISREL 8	China	Manufacturing	305	N	Y	Y
Larrán Jorge et al. (2015)	Environmental performance	Competitive performance, relative marketing	PLS-SEM	SmartPLS 2.0 software	Spain	Various sectors	481	Y	Y	Y
Lee et al. (2012)	Green supply chain management (GSCM) implementation	Employee job satisfaction, operational efficiency, relational efficiency, business performance	Statistical method of reliability, validity and goodness of fit	Not mentioned	Korea	Various sectors	223	N	N	Y
Malesios et al. (2018b)	Sustainability oriented innovation practices	Organizational performance (economic performance, quality performance,	SEM	AMOS 21	UK, France, India	Manufacturing	120	N	Y	Y

		innovation performance, environmental performance and social performance)								
Malesios et al. (2018a)	Economic indicators (turnover and business growth)	Sustainability and financial performances	Non-linear regression modeling	WinBUGS software	UK, France, India	Manufacturing	119	N	Y	Y
Maletic et al. (2016)	Sustainability oriented innovation practices	Organizational performance	Descriptive Statistical analysis-regression analysis	Not mentioned	Multiple countries-Germany, Poland, Serbia, Slovenia and Spain.	Various sectors	266	N	N	Y
Mafini and Loury-Okoumba (2018)	Green supply chain management practices (green purchasing, reverse logistics, environment collaboration with suppliers, green manufacturing)	Operational performance	SEM	Amos Version 23 software	South Africa	Manufacturing	219	N	N	Y
Masocha and Fatoki (2018)	Coercive isomorphism	Sustainability (environmental, economic, social)	SEM	Amos Version 24 software	South Africa	Various sectors	222	Y	Y	Y
Masocha (2018)	Innovation firm performance, ecological firm performance, social firm performance	Environmental sustainable development	SEM	Amos Version 24 software	South Africa	Various sectors	208	Y	Y	Y

McKeiver and Gadenne (2005)	External influences (customers, suppliers, legislation, local community)/ Internal influences (owner-manager attitudes, awareness of environmental impact, employees' concerns, benefits from implementing environmental management system)/ Size/ Industry type	Environmental management system (formal and informal)	MANOVA	Not mentioned	Australia	Various sectors	166	N	Y	Y
Panwar et al. (2016)	Cost leadership, differentiation, industry type, size of firm	Environmental engagement	Multiple regression analysis	SPSS 20.0 software	USA	Manufacturing	478	Y	Y	Y
Pinget et al. (2015)	Determinants of environmental innovation (polluting sector, environmental monitoring, external growth, cluster, R&D cooperation, firm size, age, exports, group, debit ratio, services, manufacturing)	Environmental innovation	Multinomial logit regression analysis	Not mentioned	France	Various sectors	435	N	N	Y
Raziq and Wiesner (2016)	High performance management practices (HPMP) (recruitment, selection, training and development, compensation, performance appraisal and consultation), firm performance, Financial sustainability outcomes	Market based sustainability outcome of the SME	Principal component analysis/ SEM	SPSS 19.0/ SmartPLS 2	Pakistan	Manufacturing and services	357	N	N	Y
Rashid et al. (2015)	Technology collaboration, Green human resource, eco culture, environmental management system strategy,	Sustainable development	EFA/ SEM	Not mentioned	Malaysia	automotive industry	320	N	N	Y

	eco product innovation									
Rahman et al. (2010)	Lean practices: just in time (JIT), waste minimization and flow management	Operational performance (quick delivery compared to competitors, unit cost of products relative to competitors, overall productivity and customer satisfaction)	Principal component analysis/ Multiple regression analysis	Not mentioned	Thailand	Manufacturing	187	Y	Y	Y
Rezai et al. (2016)	Perceived relative advantage, complexity, attitude, subjective norms, perceived behavioral control	Intention to adopt green practices	SEM	Amos software	Malaysia	Manufacturing	256	N	Y	Y
Shibin et al. (2017)	Pressure and top management participation	Supply chain connectivity, supply chain information	PLS-SEM	Warp PLS version 5.0	India	Auto components manufacturing	205	Y	Y	Y
Soubihia et al. (2015)	Green operational practices	Green performance	SEM	Not mentioned	Brazil	Industry	75	N	Y	Y
Sánchez-Medina et al. (2014)	Attitude towards the behaviour, perceived social norms, perceived behavioural control	Intention for environmental actions	PLS-SEM	SmartPLS 2.0 software	Spain	Various sectors	201	N	N	Y
Susanty et al. (2017)	Effect of implementation of GSCM practices (internal environmental management, green purchasing, customer	Environmental performance	Multiple regression analysis	SPSS 16.0	Indonesia	Wooden furniture industry	142	N	N	Y

	cooperation, eco-design, investment recovery)									
Sajan et al. (2017)	Lean manufacturing practices	Sustainability practices, environment practices, social practices and economic practices	SEM	AMOS	India	Manufacturing	252	Y	Y	Y
Soto-Acosta et al. (2016)	Sustainability perceptions and attitudes (social, environmental, economic)	Business performance (profitability, competiveness, effectiveness)	PLS-SEM	SmartPLS software	Romania	Various sectors	109	Y	Y	Y
Sarango-Lalangui et al. (2018)	Sector, size of the company	Sustainability practices (social, environmental, economic)	Exploratory factor analysis, t-test	SPSS 19.0 software	Ecuador	Manufacturing, services	188	Y	Y	Y
Singh and Kumar (2017)	Drivers of environmental performance (related to the organization, the customers, competition, society, suppliers and marketing)	Environmental performance	Correlation analysis/ Multiple regression analysis	SPSS	India	Various sectors	Not mentioned	N	Y	Y
Suriyankietkaew and Avery (2016)	Sustainable leadership practices	Financial performance	Correlation analysis/ Multiple	SPSS software	Thailand	Industry (excluding agricultural sector)	439	Y	Y	Y

			regression analysis							
Tomsic et al. (2015)	Innovation process, leadership, human capital, EU policy of SMEs, economic performance of enterprises, corporate sustainability	Financial performance	SEM	SPSS software/AMOS software	Slovenia	Manufacturing /Construction (majority)	645	Y	Y	Y
Turyakira et al. (2014)	CSR activities (Workforce-oriented, Society-oriented, Market-oriented, Environmentally oriented, Regulated CSR activities)	Competiveness	EFA, SEM	SPSS 18.0	Uganda	Various sectors	383	N	N	Y
Urban and Naidoo (2012)	Operational practices (Inventory management, Production planning and control, Operational specifications, Production measurement techniques, Production quality management, Manufacturing budgets and costs, Health safety and maintenance planning)	Economic sustainability (employment growth, growth in sales turnover, growth in profits, growth in market value)	Factor/correlational analysis	Not mentioned	South Africa	Manufacturing	87	N	Y	Y
Vinodh and Joy (2012)	Economic sustainability, Environmental sustainability	Social sustainability	SEM	VPLS software	India	Manufacturing	50	N	N	Y
Yusuf and Dansu (2013)	Business risk	Sustainability aspects (people, natural environment, profit)	X^2 test	SPSS 15.0, STATA version 10	Nigeria	Manufacturing, services	34	N	N	Y
Zhou (2016)	Lean tools/environmental	Implementatio	Hierarch	Not	USA	Manufacturing	34	Y	Y	Y

	management	n of lean practices	ical cluster analysis/ ANOVA	mentioned		, logistics, distribution and retail				
Zeng et al. (2011)	Environmental management, economic performance	Pollution levels	Multiple regressio n analysis	SPSS 15.0	China	Manufacturing	104	Y	Y	Y

Table A3: Summary of the findings (*Y: yes; N: no*)

Practices	Performance	Frequency	Percentage (%)
Social	Environmental	29	18.2%
Environmental	Economic	22	13.8%
Economic	Economic	17	10.7%
Social	Economic	17	10.7%
Entrepreneurial orientation	Economic	10	6.3%
Innovation	Economic	8	5.0%
Innovation	Environmental	8	5.0%
Environmental	Environmental	8	5.0%
Green	Green	6	3.8%
Green	Environmental	6	3.8%
Innovation	Social	6	3.8%
Operational	Economic	6	3.8%
Economic	Social	2	1.3%
Social	Social	1	0.6%
Economic	Environmental	1	0.6%
Environmental	Social	1	0.6%
Social	Innovation	1	0.6%
Green	Operational	1	0.6%
Innovation	Innovation	1	0.6%
Lean	Economic	1	0.6%
Lean	Environmental	1	0.6%
Lean	Social	1	0.6%
Lean	Green	1	0.6%
Eco-efficient	Economic	1	0.6%
Eco-efficient	Environmental	1	0.6%
Entrepreneurial orientation	Environmental	1	0.6%
Entrepreneurial orientation	Social	1	0.6%
TOTAL		**159**	**100%**

Table A4: Frequency table of the associations between the various sustainability practices and performance constructs

Study	Economic	Environmental	Green	Social	Operational	Lean	Innovation	Eco-efficient	Enterpeneurial Orientation
Anggadwita and Mustafid (2014)	2								
Aboelmaged (2018)	5			1	5		1		
Agan et al. (2013)		4							
Akhtar et al. (2014)				2					
Aguado and Holl (2018)				1					
Aragon-Correa et al. (2008)		11		2		3			
Battaglia et al. (2014)	7	1		4	4		2	2	
Bourlakis et al. (2014)	11				6				
Cherrafi et al. (2018)	14	2			6	15	2	5	
Choongo et al. (2017)				4					
Caputo et al. (2018)					2				
Cantele and Zardini (2018)	5	6		1					
Courrent et al. (2018)	2	6		3					
Dey et al. (2018a)									
Epoh and Mafini (2018)	6	4		3	3	3			
Habidin et al. (2016)	3	2			3				
Hami et al. (2015)					2		2	1	
Hosseininia and Ramezani (2016)				4					
Idris et al. (2017)		4	5						
Jansson et al. (2015)				2					
Juniarty and Ismail (2015)	1								
Juárez (2017)	5	3		3					
Jayeola (2015)	4	6							
Jahanshahi and Brem (2017)	2				2		2		
Kamarudin, and Aslan (2017)	5	1		1	2		1		
Koe et al. (2015)				3					
Li et al. (2017)		10							
Larrán Jorge et al. (2015)	9	9			5				
Lee et al. (2012)	11	4	5	1	2			5	
Malesios et al.									

(2018b)									
Malesios et al. (2018a)									
Maletic et al. (2016)	8	5		3	4		2		
Mafini and Loury-Okoumba (2018)	6	4	5	2	6		4	3	3
Masocha and Fatoki (2018)	5	2						5	
Masocha (2018)	10				4			2	
McKeiver and Gadenne (2005)	2							2	
Panwar et al. (2016)					1			2	
Pinget et al. (2015)	1								
Raziq and Wiesner (2016)	5							5	
Rashid et al. (2015)	5							5	
Rahman et al. (2010)						13			
Rezai et al.(2016)	5	2							
Shibin et al. (2017)	2	5		7	1			1	
Soubihia et al. (2015)									
Sánchez-Medina et al. (2014)				3				3	
Susanty et al. (2017)	4	9						4	
Sajan et al. (2017)	3	4		3	1				
Soto-Acosta et al. (2016)	3	2		5				2	
Sarango-Lalangui et al. (2018)	9	6		7	5				
Singh and Kumar (2017)	4	5			4				
Suriyankietkaew and Avery (2016)	4								
Tomsic et al. (2015)	3	6		3			2		
Turyakira et al. (2014)				5					
Urban and Naidoo (2012)	10				6				
Vinodh and Joy (2012)	3	3		2					
Yusuf and Dansu (2013)	3			3	1				
Zhou (2016)	7				5	15			
Zeng et al. (2011)	4								

Table A5: Analytical presentation of the number of sub-constructs each research paper utilized for their statistical analyses

Journal title	# of papers	Percentage (%)
Sustainability	10	18%
Journal of Cleaner Production	8	14%
Annals of Operations Research	3	5%
Procedia - Social and Behavioral Sciences	3	5%
Business Strategy and the Environment	2	4%
International Journal of Production Economics	2	4%
South African Journal of Economic and Management Sciences	2	4%
Journal of Manufacturing Technology Management	2	4%
Clean Technologies and Environmental Policy	1	2%
European Journal of Business and Social Sciences	1	2%
2nd International Conference on Business Administration, Marketing and Economics	1	2%
Industrial Management & Data Systems	1	2%
International Business Review	1	2%
International Journal of Academic Research in Business and Social Sciences	1	2%
International Journal of Business Management and Economic Research	1	2%
International Journal of Precision Engineering and Manufacturing-Green Technology	1	2%
International Journal of Process Management and Benchmarking	1	2%
International Review of Entrepreneurship	1	2%
International Small Business Journal	1	2%
Journal of Asian Scientific Research	1	2%
Journal of Business Ethics	1	2%
Journal of Environmental Management	1	2%
Journal of Food Products Marketing	1	2%
Journal of Management and Sustainability	1	2%
Journal of Management Sciences	1	2%
Journal of Small Business and Enterprise Development	1	2%
Journal of Transport and Supply Chain Management	1	2%
Management	1	2%
PLoS ONE	1	2%
Procedia CIRP	1	2%
Proceeding of Mechanical Engineering Research	1	2%
Proceedings of the World Congress on Engineering 2017	1	2%
Total Quality Management and Business Excellence	1	2%

Table A6: Summary of published research by journal